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# EUROPEAN FERNS.

## INTRODUCTION.

### ON FERNS IN GENERAL.



HERE is probably no group of plants which has more numerous or more enthusiastic admirers than the fern tribe. This, at first sight, appears somewhat remarkable, for their flowerless state deprives them to a great extent of that wonderful variety of form and hue which other plants can boast; but their ever-fresh green, and the graceful outlines of their delicate plume-like fronds, constitute strong claims to admiration, and in some measure account for the popularity which ferns have attained. Then, some of the commonest species are also some of the most beautiful; moreover, they can be grown with the greatest ease even in the back garden of a London house; they require little or no care, and once established, will go on, year by year, unfolding their graceful crosier-like fronds, and in this very point betraying their position in the vegetable kingdom. For this rolling up of the young fronds in watch-spring fashion, which in scientific language is termed *circinate vernation*, is characteristic of the fern tribe; although there are exceptions to the rule—as in the Adder's-tongue and Moonwort, in which the vernation is straight; while on the other hand, in some flowering plants, such as the Sundews, it is circinate.

We have said that ferns do not produce flowers; we might almost go farther, and say that they are equally destitute of leaves! Without putting the case so strongly, however, we shall readily perceive that the fronds of ferns differ essentially from true leaves, inasmuch as upon their under-side, or less frequently upon their margin, they bear the fructification, which a true leaf among flowering plants never does. This may at first sight seem surprising, as Cactuses and other plants, notably a pretty species of *Phyllanthus* often seen in hot-houses, and the familiar Butcher's Broom (*Ruscus aculeatus*), appear to bear flowers upon their leaves; but these seeming leaves are really stems or branches. The leafy portion of a fern is certainly not, however, a stem, but a modified leaf, and is usually known by the term *frond*. If we bear in mind that these fronds are circinate in vernation, and bear upon their backs; or edges the cases containing the spores—which spores are, in some respects, analogous to the seed in flowering plants—we shall have gone some way towards seeing how Ferns differ from Phanerogams, as flowering plants are called in scientific parlance.

The absence of flowers determines the position of ferns, then, to be in the great lower division of the vegetable kingdom—the Cryptogamia, or Flowerless Plants. What are called “flowering”



ferns we shall see presently to be merely cases in which the fructification is restricted to the upper portion of a few of the fronds, and so crowded together over the surface as to conceal it. The immense number of cryptogamic plants is further divided into two great groups, founded upon the degree of complexity of their organisation. In the lower of these—called Thallophytes, or



TREE-FERNS.

Cellular Cryptogams—there is no separation of the vegetative organs into stem, root, and leaves, but the plant consists of a cellular structure (*thallus*) of homogeneous character. Fungi, Seaweeds, and Lichens, are examples of these Thallophytes. The higher group, on the contrary, has a differentiation of stem and leaf in nearly all cases, and the plants contained in it are called Cormophytes, or Vascular Cryptogams. The Mosses are the humblest of these Vascular



Cryptogams, whilst the Ferns present us with the most highly developed and conspicuous living representatives of the group (for we do not now speak of extinct plants). The scientific name for the family of Ferns is *Filices* or *Filicinae*.

## STRUCTURE.

Let us now bring before our notice the different parts or organs of which ferns are made up, and briefly examine their various modifications and structure.

By far the great majority are perennial, one of the few annual species being *Gymnogramme leptophylla*, fully described in the following pages. In appearance, as well as in what the botanist calls habit, they present infinite variety, some being very small, delicate, creeping, and moss-like, others rigid and leathery, whilst others, attaining the height and appearance of palms, are called Tree-Ferns. The main cause of this variety is due to modifications of the stem, which we proceed to describe.

STEM.—The stem of a fern is either erect or creeping, and either subterranean or above ground. When under ground it usually receives the erroneous name of root, but its structure is the same whether above or beneath the surface of the ground. Good examples of the erect form of stem, called the *caudex*, are seen in our British Male Fern (*Nephrodium Filix-mas*), or Lady Fern (*Athyrium Filix-fœmina*), or in the Royal Fern (*Osmunda regalis*), when they have attained to a considerable age; but here the caudex rises at the best but a few inches above the ground. To see the erect stem in its highest development we must look at the tree-ferns of hot countries, none of which occur in Europe in a wild state, although they may be seen in the hot-houses of any of our large gardens, some very beautiful examples being noticeable in the tropical fern-house of the Royal Gardens, Kew. These show us an erect, slender or thick, column-like trunk, without branches, and with all its fronds borne upon its summit, and usually forming a beautiful spreading and drooping crown. The older part of the stem is either covered with the dry bases of the fronds of past years, or its surface is marked by their scars, and in all erect stems these are placed close together, and the scars form a diagonal pattern, as shown in the accompanying figure. Not unfrequently, the real stem is of small size, the bulk being composed of these persistent bases of the leaves, as is the case in our Male Fern. The true roots, which are long, tough, slender, and fibrous, and usually dark in colour, are given off on all sides of the caudex at the bases of the fronds, and often in the tree-ferns form a pyramidal or conical mass round the stem down to the ground; this is well seen in the *Dicksonia antarctica* of our conservatories. These roots may become welded together so as to form a solid wood-like mass, as in *Cyathea medullaris* of New Zealand, where it is called “weki,” and cut into slabs by the Maoris. The caudex of this fern reaches a height of over a hundred feet, but the ordinary height of tree-ferns is from twenty to fifty feet, and some are much smaller: thus, *Todea Wilkesiana* of the Fiji Islands has an erect stem about seven feet high, and only as thick as a walking-stick. It is very uncommon for these erect stems of ferns to branch or divide.



EXTERNAL SUR-  
FACE OF STEM  
OF TREE-FERN.

In some creeping caudices which are above ground, and anchor themselves to it by roots, the fronds are also crowded, and form a tufted crown; but much more usually such stems or rhizomes bear the fronds at intervals (or, as botanists would say, the *internodes* are developed). The intervals between the origin of fronds are longer or shorter in different cases. Our common Polypody (*Polypodium vulgare*), or, still better, the Hare's-foot Fern (*Davallia canariensis*), are



examples of this mode of growth, in which the growing end of the rhizome will be seen to be always in advance of the last leaf. This is still more the case in the Filmy Ferns (*Hymenophyllum*) where the long, slender, prostrate rhizome develops several internodes beyond and before the youngest leaf. Most of such stems in our ferns are subterranean, as the common Bracken, the Marsh Fern (*Nephrodium Thelypteris*), in both of which they are considerably branched, or bifurcated, and either smooth or covered with a fine coating of hairs. When above the ground they are generally, when young at all events, set with close scaly bodies, usually brownish in colour, dry, membranous, and lightly attached; these are called *paleæ* or *ramenta*, and are conspicuous in the Hare's-foot Fern. The roots in these creeping species are not connected with the bases of the fronds, but come off irregularly from the rhizome; some *Hymenophyllums* have no roots, but the stems are then covered with absorbent hairs, which perform the same function.

The internal structure of Fern-stems, though of great interest to the botanist, is not to be understood without a long technical description, which would be here quite out of place. The accompanying woodcut will show that, even in a large tree-fern with a thick stem, no wood is



TRANSVERSE SECTION OF  
STEM OF TREE-FERN.

formed, the hard tissues, forming what are known as the *fibro-vascular bundles*, being few in number, large, and separate, and forming a regular circle in the soft substance of the stem, but not consolidated into a mass of wood. There is also no pith in these stems, nor any separable bark, though the outer layers of tissue are sometimes hardened and brown.

FRONDS, OR LEAVES.—It is to these organs that the name Fern is generally given in popular language, and in them a very great diversity in form, size, and mode of division is found. There are a few points common to all fronds which must, however, be here mentioned. The stalk, or petiole, or *stipes*, is the part which connects the frond with the stem, and it is like the foot-stalk of a leaf, either articulated with its support or continuous with it: articulated and therefore deciduous fronds

are rare; they have been called *erembryoid*, whilst the ordinary non-articulated adherent ones are termed *desmobryoid*. The Hare's-foot and the common Polypody are examples of the first group; and the veteran pteridologist, Mr. John Smith, of Kew, who first noted this distinction, states that ferns of the *erembryoid* group are endowed with much greater tenacity of life, and are more readily grown from spores than those belonging to the *desmobryoid* section. The frond-stalk (*stipes*) is usually stiff and erect, and is very often covered, especially at the base, with *paleæ* similar to those on the caudex; it is circular or flattened, and on a section it exhibits the fibro-vascular bundles\* continuous with those in the stem—for each frond is always given off from opposite an opening in the meshes of the fibro-vascular cylinder in the stem, and its bundles are connected with those forming the margin of the opening. The base is often thickened or dilated, and, in the species with closely-placed fronds, gives off two or three roots.

The continuation or upper part of the *stipes* bearing the blade of the frond is called the *rachis*; in much-divided ferns the *stipes* has rather the appearance of a stem, and this is especially the case in the Climbing Fern (*Lygodium*), where the *rachis* is of indefinite length and completely simulates a stem. Mr. Darwin† states that these Climbing Ferns do not differ in their habits from other twining plants. In *Lygodium articulatum* the two internodes of the *rachis* which are first

\* The structure of the *stipes* of most of the European species is fully described and well figured by M. Duval-Jouve, in Billot's "Annotations à la Flore de France" (1855—62).

† "Climbing Plants," p. 38.



formed above the root-stock do not move ; the third from the ground revolves, but at first very slowly. This species is a slow revolver : but *Lygodium scandens* made five revolutions, each at the average rate of 5h. 45m. ; and this represents fairly well the usual rate, taking quick and slow movers, amongst flowering plants. The movement is in the usual direction—namely, in opposition to the course of the sun ; and when the stem twines round a thin stick it becomes twisted on its own axis in the same direction. In *Gleichenia* and other tropical ferns the rachis is dichotomous, or forked. When, as in the Hart's-tongue, the frond is undivided, the rachis forms its mid-rib : but more usually the frond is more or less broken up into separate portions, and as in describing ferns it is necessary to use some terms expressing the nature of such division, we must here explain them. If the division does not extend down to the rachis, the frond still remains in a single piece, and the term *segment* is applied to the lobes, the frond being said to be *pinnatifid* or *pinnatisect* ; and should these lobes be again partially cut into segments, the frond is called *bipinnatifid* or *bipinnatisect*. More generally, the division is more complete, and the frond is separated down to the rachis : the separate portions are then termed *pinnæ*, and the frond said to be *pinnate* ; each pinna may be divided again into segments (*pinnatisect*), or cut into separate *pinnules*—when the frond is *bipinnate*. A further division results in a *tripinnate* fern, where the pinnules are divided into *tertiary divisions*. It is rare for fronds to be more compound than this, but the *ultimate divisions* are always described, and may be lobed, or toothed, or quite *entire*.

Another important point to be observed is the *venation*, or the arrangement of the little veins or nerves which run in the substance of the frond. These are easily observed, and will be found very varied in character. Of course the simplest form is that where a single vein (*mid-rib* or *costa*) runs down the centre of the segments, and this is seen in the filmy *Hymenophyllæ*. More frequently there are secondary veins (veinlets) coming off in a pinnate manner from the central one, and running parallel to one another to the edge, or these may be forked, the branches proceeding to the margin, and ending before they reach it. This latter is a very common form, and may be seen in the Male Fern and the Bracken. Another type is found in the Maiden-hair, where there is no mid-rib, but the veins radiate in a fan-like way from the base. All these are cases of *free venation*, the separate veins, even when branched, never uniting again ; but there are numerous cases of *anastomosing venation*, where the branches of separate veins unite with one another to form a network of various kinds. Mr. John Smith, of Kew, Mr. T. Moore, of Chelsea, and other writers on Ferns, have very carefully observed these differences, and have reduced the kinds of anastomosing venation to about seven different types. These it is not necessary to define here, as they are not represented in the European species to any extent. *Woodwardia*, however, affords a good example of one of the forms of anastomosing venation, in which the veinlets are connected by little arched veins, and form thus many small spaces or *areolæ*.



PINNA OF MAIDEN-HAIR.

By some writers a decided difference in venation is considered sufficient to make separate genera of ferns, whilst others pay little attention to this, and include in the large genera, such as *Polypodium* and *Acrostichum*, plants showing all the above varieties. It is this difference of treatment which causes the very great diversity in the estimate of the number of fern genera, and is one great reason of the numerous names (synonyms) which so embarrass the student.

The growth of the fronds of ferns is very slow, much more so than that of the leaves of flowering plants. It takes two years to form a frond of the Male Fern, and others are probably longer in course of evolution before they commence to expand. When first noticeable they are closely curled up, the whole frond being rolled in on itself from sides and top, and forming a



crozier-like body. In botanical language, the vernation or ptefoliation is *circinate*, and this is very characteristic of ferns and very rare in other plants. One order of ferns, however, does not have this kind of vernation, the *Ophioglossaceæ*, containing the Adder's-tongue and Moonwort, and from this and other special characters the group is often separated from the true ferns. Another

peculiarity of the development of fronds is that the base is first formed and first unrolled, as any one can see in watching the expansion of a large fern, the lower portion being quite spread out, whilst the upper part is still in process of evolution. In some cases the growth of the top continues for a long time, as in the Climbing Fern (*Lygodium*); this kind of growth is called *basifugal*.

We shall presently see that the fructification is produced on the fronds. Usually all the fronds produce fructification, to a greater or less extent, according to accidental circumstances; but in a considerable number of ferns there are always some *fertile* and some *barren* fronds, bearing definite relations to one another, and very generally the two kinds of fronds differ considerably in form, size, and often in shape. Our Hard Fern (*Blechnum boreale*) and the Ostrich Fern (*Onoclea Struthiopteris*) are examples. This *dimorphism*, as it is called, in the two kinds of fronds, may be carried to an extraordinary extent, as in the Elk's-horn (*Platycerium alcicorne*), familiar in our greenhouses, where the barren fronds are flat, small, and undivided, and spread out over the surface on which the fern grows, while the fertile ones are erect, large, and branched like a stag's antlers. Another very striking example is found in *Trichomanes* (*Hymenostachys*) *elegans*, where the sterile fronds are numerous and deeply pinnatifid, much as in the common Polypody, whilst the fertile ones are only two or three in number, and simply linear with the numerous receptacles crowded along the edge. Or we may instance *Polypodium* (*Drynaria*) which well deserves its specific name (*diversifolium*) since the two kinds of fronds are so



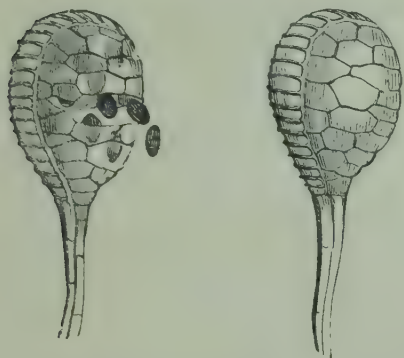
THE MOONWORT (*Botrychium Lunaria*).

different that they would be supposed to belong to quite distinct plants; the sterile ones are a few inches long, sessile, oblong-ovate, slightly lobed, and brown in colour like a dry oak-leaf; the fertile are from two to four feet in length, on long stalks, with long distant, linear, bright green pinnæ. We might give many other remarkable cases, but we must now pass on to consider the fructification itself.

*Fructification.*—As above remarked, ferns have no flowers; consequently, they have no seeds, for seeds can only be produced by flowers of some kind or another. The little bodies which reproduce—after some curious changes and developments, to be presently noticed—the Fern-plant are, as in the case of other Cryptogamic plants, called *spores*. They are excessively small, and contained in little capsules, called *sporangia*, of which we shall presently speak. These *sporangia*, or capsules, are variously arranged, but there are always several, often very many, together, and the group which they form is termed a *sorus*, the point at which they are attached being called the *receptacle*. The sori are the little patches, usually brown in colour, so noticeable on the under surface of fully-grown fronds, which distinguish them also so readily from true leaves. They vary very much in their position and arrangement, and upon these points the classification of ferns is very largely based. It will be found, on examination, that in most cases



the sori have some definite relation to the veins of the frond, the receptacle being usually situated at the extremity or on the back of a vein; but this is not always the case. The most familiar form of sorus is circular, as is seen in the Male Fern and Polypody; frequently they are oval or oblong, as in many *Aspleniums*; at other times elongated and linear, as in the Hart's-tongue. When they occupy the margin of the frond or its under-surface, as in the Bracken, several sori are confluent to form the long line of fructification; and in some foreign ferns (*Acrostichum*, *Platynerium*) the sori occupy the whole under (and even upper) surface of the frond with a continuous layer. In the Filmy Ferns the sori are marginal and quite peculiar, the receptacle extending beyond the edge of the frond, and being, in fact, the end of a vein. In many Ferns which have special fertile fronds the fructification is often greatly crowded, so that the leafy portion becomes contracted and curled up so as to



SPORANGIA OF FERNS, SHOWING DISTRIBUTION OF SPORES.

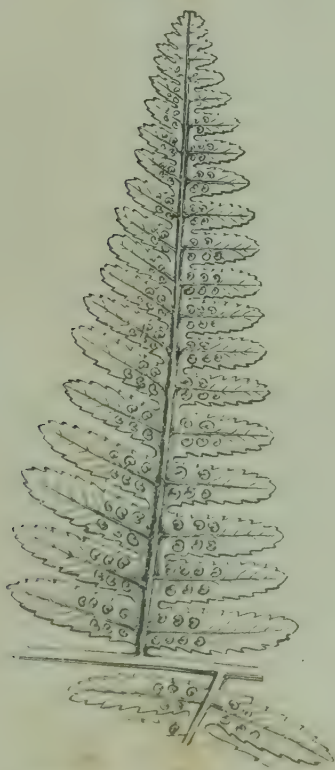
be scarcely observable, and this former seems to constitute by itself a spike or raceme of fruit; this is noticeable in the Parsley Fern and the Royal Fern amongst European species, and is still more remarkable in some exotic ones.

The *sporangia*, or capsules, are very characteristic in form, and of a remarkable constitution. They are delicate little sacks, with thin, semi-transparent walls, and are attached to the receptacle either by a slender stalk or are sessile. In shape they are usually

oval, blunt, and a little lop-sided, in consequence of the existence of a ring, which runs vertically round one side and over the top, which is called the *annulus*. This is a provision of Nature for causing the bursting of the sporangium, which happens by the contraction (from drying up) of the ring, and the consequent rupture transversely of the wall on the opposite side, which allows the escape of the contained spores. In the Filmy Ferns, however, the ring is horizontal and extends round the whole sporangium, hence the splitting here is vertical; the splitting is also vertical in *Osmunda*, where the ring, however, is very faint and imperfect. In *Ophioglossum* and *Botrychium*, what are still called the sporangia are wholly different from those above described, and are modified portions of the frond, and the spores are formed from changes taking place in its inner tissue. All these points are considered by the botanist of fundamental importance.



SPORANGIA OF MALE FERN.



UNDERSIDE OF PINNA OF MALE FERN.

Another organ connected with the sori must also be examined, for though of less intrinsic value to the plant, it is principally employed in the classification of ferns generally adopted. This is the *indusium*, or involucre, which is a membranous body of various form, which covers to

a greater or less extent the sorus. It is very readily observed in most ferns, as our Male Fern, and as a rule is of much the same form as the sorus, with which it is connected. In a number of species, however, it does not exist at all, as may be seen in the Polypody, in which the sori are naked at all periods of their existence. In some cases the involucre is difficult to



observe, either from its small size or from becoming torn and withered, or being concealed by the numerous full-grown sporangia. It is quite necessary always carefully to examine into this point. In the case of the covering found in several marginal sori, in which the edge of the frond is turned back and partially covers the sporangia, it is not always easy to say whether there is an indusium present or not. Thus, in the Parsley Fern we have the reflexed portion of the edge of the frond scarcely altered at all, whilst in *Pteris cretica*, *Adiantum*, and other ferns, there is a distinct membrane extending from the margin, and more or less covering the line of sori. In the uncertainty as to the true nature of this organ it is convenient to call it a *false indusium*. Our common Bracken shows, besides this false indusium, a true indusium also, which is situated beneath the sori. And this leads us to notice that the indusium may be either inferior—*i.e.*, forming a cup or a scale below the sporangia—or (more usually) superior, when it covers them. Examples of the former kind are seen in the Ostrich Fern, and very beautifully in the little Woodsias; also in the species of *Cystopteris* and in the Filmy Ferns, all of which kinds present differences which are fully described in the succeeding pages. The superior indusia present less variety. They form, when young, a complete investment over the sporangia, but as the latter become ripe the indusium becomes detached at its edge. Their attachment is generally to the receptacle, either by their centre to its summit or at the side.

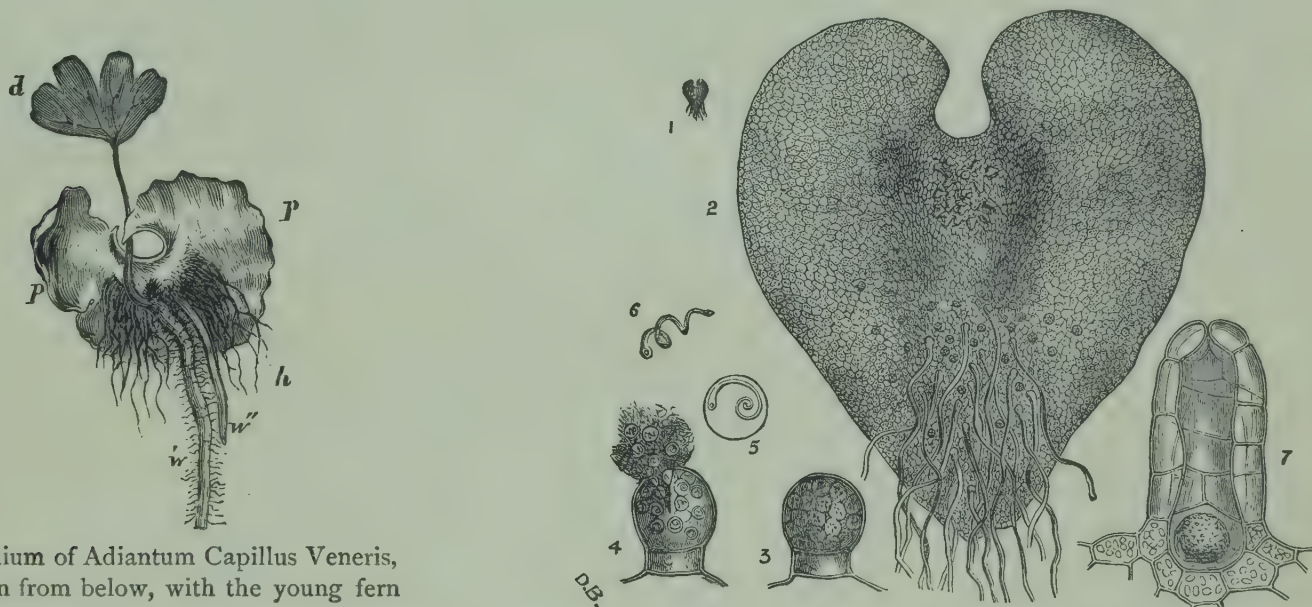
*Mode of Reproduction.*—We have seen that the spores are liberated from the sporangia when ripe by the rupture of the latter; we have now to examine in what way the new fern has its origin. When the spores fall in a suitable damp place, they, usually after some little period, germinate. But their germination is quite unlike that of a seed; there is no young embryo plant in the spore, and no putting forth and unfolding of a delicate root and little fronds belonging to a young fern. A plant is produced, to be sure, but it is wholly unlike the parent. The germination of fern spores can readily be watched in any hot-house, and what is seen as the result is a very small, flat, membranous green body, which is attached to the soil by several delicate rootlets. Its outline varies, but is usually more or less circular or kidney-shaped; its transparent, clear, green, and cellular texture gives it a great similarity to the little plants called Liverworts. To this structure the name *prothallium* is given. Though so delicate a structure, it is not always an evanescent one, and may even last several years.

The prothallium seems to have been first clearly seen by Dr. Lindsay, whose observations are recorded in the "Transactions of the Linnean Society" for 1792 (vol. ii., p. 93). He well figures the commencement of the new fern, but it was not for many years after that the *mode* in which it originated from the prothallium was understood. It was in the year 1844 that the mystery was cleared up by the discovery of the reproductive organs—which everybody had hitherto looked for upon the mature fern—on the minute prothallium. These organs are necessarily of two kinds, and may be roughly considered to be analogous to the stamens and pistils of flowering plants. They are, of course, very minute, and require the microscope for their examination, and are termed *antheridia* and *archegonia*. In the great majority of cases both kinds are found on the same prothallium; their usual position is on the under-surface, the antheridia among the rootlets at one end, and the archegonia in the kidney-shaped prothallia, just behind the indented portion. The antheridia are minute cellular sacks, which burst, when mature, to liberate a number of microscopic, spirally-twisted, ciliated bodies endowed with movement, and called *spermatozoids*. The archegonia are larger and bottle-shaped, with a rather long neck, and contain at the base a minute central cell, which is the



*oosphere*. It is this little oosphere which gives origin to the new fern. After the spermatozoids escape, some of them pass down the neck of the archegonium, and by their action on the oosphere fertilise it, and set up in it the series of changes resulting in the growth of a new plant. This new plant is at first, of course, very small, and draws its nourishment from the prothallium to which it remains attached, but it is soon evident that it is developing, not into a prothallium, but into a fern, like its grandparent. It soon becomes established with roots of its own, and the prothallium disappears.

It will thus be seen that the reproduction of ferns is very different from that of flowering plants, though a more or less similar mode is very general in the Cryptogamia. Two generations are necessary to complete the cycle of life of the plant, and thus the alternate generations are different. It may be as well to mention, however, that occasionally the new



Prothallium of *Adiantum Capillus Veneris*, seen from below, with the young fern attached to it.

*p p.* Prothallium  $\times$  about 30 times; *d.* The young fern; *w' w''*. Its first and second roots; *h.* Root-hairs of the Prothallium. (After Sachs.)

1. Prothallium of *Aspidium Filix-mas*, natural size; 2. The same, much enlarged; 3. An Antheridium before bursting; 4. The Antherozoid-cells escaping from the Antheridium; 5. An Antherozoid-cell; 6. An Antherozoid; 7. An Archegonium: all much enlarged. (After Berg and Schmidt.)

fern arises from the prothallium by a process of budding, without the intervention of reproductive organs, as was first observed by Dr. Farlow, of Boston, U.S.A.

Besides the true sexual reproduction above described, ferns, like other plants, are capable of increase by means of buds and offsets. Many species constantly *viviparous* in this way are in cultivation; the buds are either scattered over the fronds or produced in the axils of the pinnæ. Other species root at the end of the fronds, and so produce there new plants.

#### CLASSIFICATION OF FERNS.

It is not our intention here to exhibit the classification of the whole of the ferns, further than to point out the main divisions into which they fall. But it will be convenient to show the system upon which the European ferns are most readily arranged, although in the following pages this arrangement has not in every case been strictly followed, and to give the botanical characters of the different genera to which they respectively belong.

The above account of the structure of ferns will have shown that there is not a very great amount of difference between the various kinds. We have not, as in flowering plants, organs

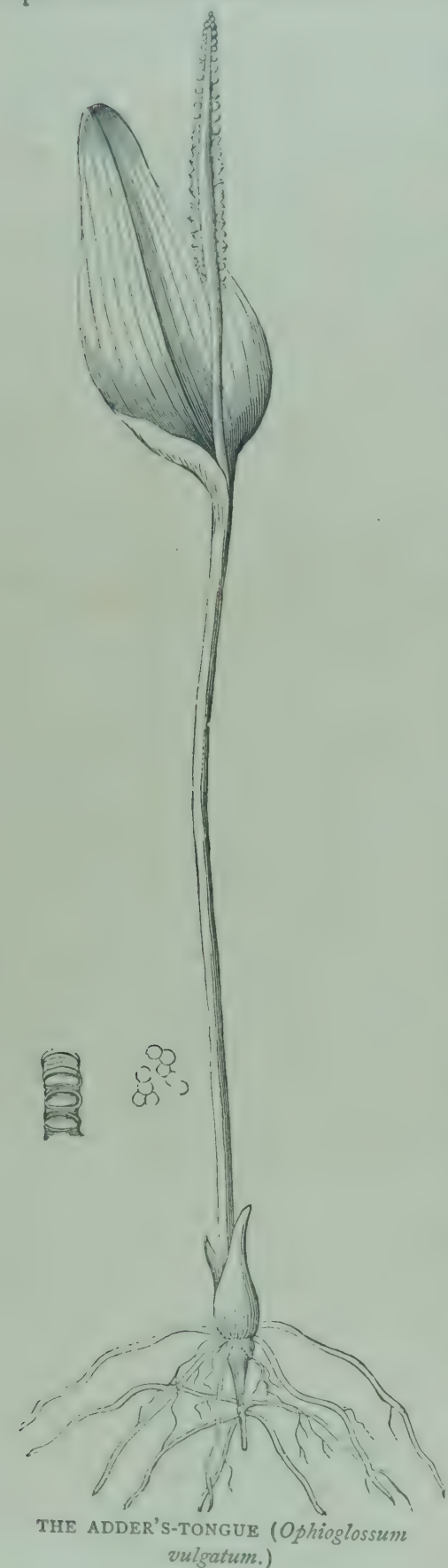


like the calyx, corolla, stamens, and pistil, susceptible of almost infinite variety and modification, upon which the numerous genera are based. The minute reproductive organs on the prothallia

of ferns have as yet been examined in comparatively few species, and even the prothallia themselves have not afforded any points of difference which can be used for classification, and the botanist accordingly does not take them into consideration. But the organs on the fully-developed fern connected with the production of the spores—that is, the sporangia both individually and as combined with sori and the indusium—present us with important modifications, and it is these which are principally used in the classification generally followed. It is therefore quite necessary, when determining the name of any fern, first of all to examine these parts, by which alone its position can with certainty be ascertained.

Before attempting to classify the bulk of our species, there are two genera which are so very different from all the rest as clearly to belong to a group of themselves: these are *Ophioglossum* and *Botrychium*. Their appearance is quite unlike that of the remainder of our species; their fronds when young are not circinate, and the spike of fructification is given off from the base of the barren one; the spores, too, are contained in cavities very unlike, and indeed quite different in origin from, the sporangia of other ferns. So fundamental are these points (and there are others), that the *Ophioglossaceæ* are by some botanists removed from the true ferns altogether, and constituted a distinct family. It contains one other genus, not European, called *Helminthostachys*.

The great bulk of ferns remain, and they are found to fall under seven groups, of which the distinguishing marks are given below; but only three of them have representatives in Europe—the *Hymenophyllaceæ*, the *Polypodiaceæ*, and the *Osmundaceæ*, and by far the greater part belong to the second of these, which contains, indeed, three or four times more species than all the other groups put together, and has to be divided into a number of tribes. Of our European Ferns, *Trichomanes* and *Hymenophyllum* fall under the *Hymenophyllaceæ*, and *Osmunda* under the *Osmundaceæ*; all the remainder belong to the *Polypodiaceæ*. The above-named ferns are each so characteristic as to be readily recognised, and the difficulty of determining the genus to which any specimen belongs can scarcely occur with any of them. It is different with the *Polypodiaceæ*, and we must now say a few words on the classification of this great sub-order.



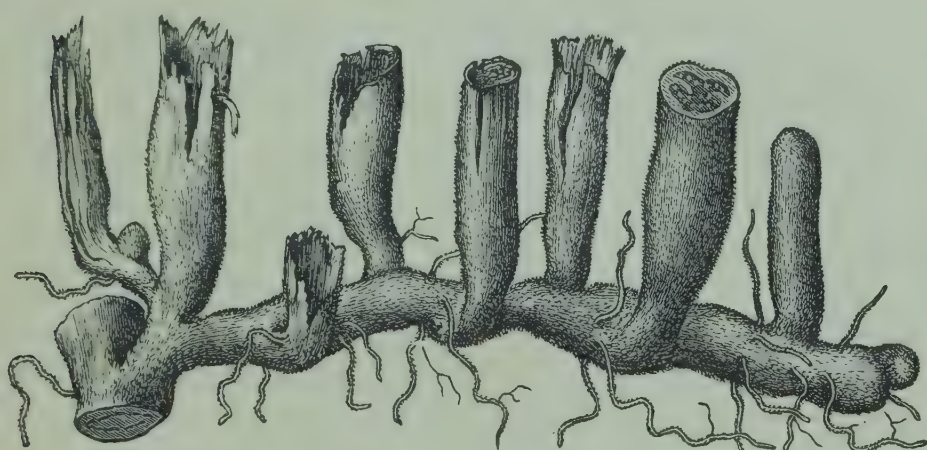
THE ADDER'S-TONGUE (*Ophioglossum vulgatum*.)

Many plans have been proposed for grouping this: the character of the rhizome—desmobryoid or cremobryoid (see above\*); the venation, and the habit; but the most convenient single

\* These two terms have been unfortunately transposed at p. iv.



point for a primary division is found in the existence or absence of an indusium to the sori. This is the first thing to be looked for, and from what has been said above, in our description of the indusium, it will be seen that the necessary examination must be careful, or the indusium



DESMOBRYOID RHIZOME OF *PTERIS AQUILINA* (half natural size).  
(After Sachs.)

really present will be overlooked. Taking the whole world, there are recognised eleven distinct tribes of *Polypodiaceæ*—eight with an indusium and three without it. Of these two (in each division, one) have no European representative. The differences are briefly given in the table of classification below, and will be seen to depend chiefly on the nature and form of the indusium (where present), and the form and position of the sori. Under each tribe we have given the genera (nineteen in all) of the European Fern-flora, with the distinguishing character of each, so that it is hoped that the reader will be able to ascertain the genus of an unknown species without much difficulty. For the description of the species themselves he must of course refer to the body of the work itself, to which this sketch is only intended as an introduction. The sub-order *Hymenophyllaceæ*, which is here placed at the head of the list, follows the *Dicksoniæ* in the body of the book. The classification involves the use of a number of technical terms which at first sight appear somewhat alarming; but an explanation of all of them will be found in the preceding pages.



EREMBRYOID RHIZOME OF *POLYPODIUM VULGARE* (half natural size), SHOWING SCARS OF FALLEN FRONDS.

#### CLASSIFICATION OF THE GENERA OF THE FERNS OF EUROPE.

Sub-Order I. *HYMENOPHYLLACEÆ*.—Sporangia sessile, rounded but compressed, surrounded by a complete transverse ring, splitting vertically, and seated on a long, stalk-like receptacle, which is terminal or marginal, continued from the end of a vein. Indusium inferior, half-cup-shaped. Ferns with membranous filmy fronds, and a filiform, long, creeping caudex.

Genus 1. *Trichomanes*.—Sporangia occupying the base of the very long receptacle which is exerted beyond the truncate indusium.

Genus 2. *Hymenophyllum*.—Sporangia occupying the whole (or nearly so) of the shorter receptacle which is contained within the two-lipped indusium.

[Sub-Order *Gleicheniaceæ*.—Sporangia sessile, surrounded by a complete transverse ring, splitting vertically, very few (from 2 to 10) combining to form dorsal sori, which have a short receptacle. No indusium. Ferns with a creeping caudex and rigid dichotomously-branched fronds. No European genus.]



[Sub-Order *Cyatheaceæ*.—Sporangia sessile or stalked, surrounded by a vertical or rather oblique incomplete ring, splitting transversely, very numerous, and seated on a barrel-shaped receptacle to form dorsal globose sori. Indusium inferior, or none. Usually tree-ferns. No European genus.]

Sub-Order II. POLYPODIACEÆ.—Sporangia stalked, furnished with a usually incomplete vertical ring, splitting transversely, numerous, forming dorsal or marginal sori, with the receptacle not prominent. Indusium present or absent.

\* With an indusium, true or false. (*Involucrataæ*.) Tribes 1—7.

Tribe 1. *Dicksoniæ*.—Sori globose, situated on the back or apex of a vein. Indusium inferior, either covering the whole sorus, and bursting irregularly, or cup-shaped. Venation free or anastomosing.

Genus 3. *Onoclea*.—Fronds dimorphic, the fertile ones contracted. Indusium semi-circular, becoming ragged and evanescent. Sori dorsal, confluent.

Genus 4. *Woodsia*.—Fronds uniform. Indusium completely cup-shaped, with a fimbriated margin. Sori dorsal.

Genus 5. *Dicksonia*.—Fronds uniform. Indusium forming with the segment a marginal two-lipped pouch. Sori terminal.

Tribe 2. *Davalliæ*.—Sori marginal or nearly roundish. Indusium scale-like, inferior, attached by a broad base, and free or attached to the frond at its sides.

Genus 6. *Davallia*.—Indusium attached by a semi-circular base and sides, upper margin free. Sori marginal or terminal.

Genus 7. *Cystopteris*.—Indusium attached by its base only. Sori dorsal.

[Tribe *Lindsayæ*.—Sori in a line at edge of the frond, and covered with its margin. Indusium membranaceous, short. No European genus.]

Tribe 3. *Pterideæ*.—Sori marginal, oblong or linear. False indusium, formed from the inflexed margin of the segment, of the same shape as the sorus, opening inwardly.

Genus 8. *Pteris*.—Sori occupying the intra-marginal arched nerve connecting the veins, and covered with a continuous false indusium; a true indusium also present in one species.

Genus 9. *Adiantum*.—Sori occupying the upper part of the veins on separate lobules, and covered by distinct reflexed false indusiums. Fronds smooth.

Genus 10. *Cheilanthes*.—Sori occupying the thickened apices of the veins, and covered by the reflexed false indusium. Fronds very hairy.

Genus 11. *Cryptogramme*.—Sori occupying the unaltered apices of the veins, oblong, covered by the reflexed margin of the frond. Fronds dimorphic.

Tribe 4. *Blechnæ*.—Sori dorsal, parallel with the mid-rib and edge of the segments, but not close to the latter, oblong or linear. Indusium superior, opening towards the mid-rib.

Genus 12. *Blechnum*.—Fronds dimorphic. Sori in a continuous line, on longitudinal anastomosing veins.

Genus 13. *Woodwardia*.—Fronds uniform. Sori in an interrupted line.

Tribe 5. *Asplenicæ*.—Sori dorsal, attached to the veins, and oblique with respect to the mid-rib, linear or oblong. Indusium as in the last, sometimes double.

Genus 14. *Asplenium*.—Sori linear, straight. Indusium nearly flat. Frond not scaly beneath.

Genus 15. *Athyrium*.—Sori oblong-reniform. Indusium with a fringed margin



Genus 16. *Ceterach*.—Sori linear. Indusium very narrow, erect. Frond covered on the back with chaffy scales.

Tribe 6. *Scolopendricæ*.—Sori as in the *Asplenieæ*, except that the indusia are arranged in pairs, and open towards each other.

Genus 17. *Scolopendrium*.

Tribe 7. *Aspidieæ*.—Sori dorsal, round or nearly so. Indusium superior, attached by its centre or an indentation.

Genus 18. *Aspidium*.

\*\* Without an indusium (*Exinvolucratæ*). (Tribes 8 and 9.)

Tribe 8. *Polypodieæ*.—Sori dorsal, round or nearly so.

Genus 19. *Polypodium*.

Tribe 9. *Grammitideæ*.—Sori dorsal, linear or long-oblong.

Genus 20. *Nothochlæna*.—Fronds very densely clothed with paleæ beneath.

Genus 21. *Gymnogramma*.—Fronds without paleæ.

[Tribe *Acrosticheæ*.—Sori not confined to the veins, but spread over the under-surface (or both surfaces) of the frond. No European genus.]

Sub-Order III. OSMUNDACEÆ.—Sporangia stalked, furnished with a short horizontal bar or very incomplete ring, splitting vertically.

Genus 22. *Osmunda*.

[Sub-Order *Schizæaceæ*.—Sporangia sessile, crowned by a small, complete, opercular ring, splitting vertically. No European genus.]

[Sub-Order *Marattiaceæ*.—Sporangia without a ring, opening by a pore at the apex, and usually fused together into a concrete mass. Vernation circinate. No European genus.]

Sub-Order IV. OPHIOGLOSSACEÆ.—Sporangia without a ring, opening down the side nearly to the base. Vernation erect, not circinate.

Genus 23. *Ophioglossum*.—Sporangia in two rows, connate, two-valved, forming a distichous spike.

Genus 24. *Botrychium*.—Sporangia separate, two-valved, forming a branched panicle.

#### GEOGRAPHICAL DISTRIBUTION OF FERNS.

Ferns are generally distributed over the globe, being least frequent in the polar regions, and most abundant in the tropics, where they attain their most magnificent proportions and fullest development in the form of the tree-ferns, which are confined to those regions, or extend but slightly beyond them, as in the case of a few species of *Cyathea*, *Dicksonia*, and *Alsophila*, which occur in the Cape and New Zealand. Mr. Baker has treated the subject at length in the twenty-sixth volume of the "Transactions of the Linnean Society," and his paper, to which we acknowledge our obligations, should be consulted by those who wish to obtain a more complete view of the matter than can be attempted in a sketch like the present. He says that here, if anywhere, we may hope to find a large order, with distinctly marked and clearly definable climatic relations. "Without a single prominent exception, we find that the whole order, of between two and three thousand clearly marked species, requires shade and a damp atmosphere, that everywhere within the tropics there are no ferns at all (or very few) in the dry countries and provinces, that, with the precision of an hygrometer, an increase in the fern vegetation (it may be in species, or it may be in the number and luxuriance of individuals, but usually in both) marks the wooded humid regions, and that,



receding from the tropics, although with latitude, the species diminish in number, there is the same contrast between the two categories of climate—the dry continental type with a large, and the damp insular type with a small hiberno-æstival range.”

The view taken of species in Mr. Baker's comparative lists, like that in the “Synopsis Filicum,” is somewhat larger than that adopted by most writers; but following it for purposes of comparison, we learn that only twenty-six species are found in the Arctic zone, of which all but two, *Athyrium crenatum*, and *Aspidium fragrans*, are natives of Britain. Tropical America and tropical Asia—the latter including the Polynesian islands—are the two richest regions in ferns. In tropical Asia there are eight hundred and sixty-three species, of which four hundred and seventy-seven are peculiar to that region, while tropical America has nine hundred and forty-six species, seven hundred and eight of which do not occur elsewhere. Of course this estimate is slightly below the actual number of ferns at present known, more than ten years having elapsed since its publication; but the numbers are relatively correct. One remarkable feature connected with the distribution of ferns is the large proportion they bear in the vegetation of some of the African islands. Thus in the Mascarene Archipelago—understanding by this term the islands of Madagascar, Mauritius, Bourbon, and the Comoros—there are more than two hundred species of ferns, more than double the number of the most fully represented order of flowering plants, *i.e.*, the Orchidaceæ; while there is reason to believe that, in Madagascar, at any rate, many ferns have yet to be discovered, as recent collectors have quite lately added several species to the list. In the little island of Tristan d'Acunha, the proportion of ferns to flowering plants is remarkably large, there being no less than twenty-three of the former to twenty-nine of the latter. St. Helena comes next of known floras to Tristan d'Acunha, in the proportion which ferns bear to phanerogamia, which is nearly as two to three, and it is very remarkable from the fact that half of them are peculiar to it.

Among the European ferns there are some which do not extend beyond the continent; these are, *Hymenophyllum Wilsoni*, *Asplenium germanicum*, *A. Heuffleri*, *A. Petrarchæ*, *A. fissum*, *A. Seelosii*, *Cystopteris alpina*, *C. sudetica*, and *Cheilanthes hispanica*, the two first being British species. *Aspidium æmulum* and *Davallia canariensis* are only a little less restricted in their range, the former (which in Europe is confined to Britain) occurring also in Madeira and the Azores, while the latter is confined to Spain and Portugal, and the islands of Madeira and Teneriffe.

Ferns reach their maximum concentration in tropical America, “amongst the dripping rocks of the higher level of the Andes, the forests of their slopes and ravines, and the dense humid flats that border the innumerable branches of the Amazon, where the sun's rays and the wind never penetrate the recesses of the primeval jungles, and climbers and parasites contest with the leaves of bright flowering trees for the possession of the branches.” About nine hundred and fifty species are found in this region, constituting forty-two per cent. of all known ferns, and more than three out of four are quite peculiar to it. For tropical Asia and Polynesia, eight hundred and sixty-three species were on record at the date of Mr. Baker's paper, of which four hundred and seventy-seven are peculiar to the district; the Polynesian list containing three hundred and eighty species, of which a hundred and fifty are peculiar. In tropical Arabia we have a million square miles “almost a blank, so far as ferns are concerned.” The fern-flora of tropical Africa (including the islands of the Mascarene group) has three hundred and forty-six species, of which a hundred and twenty-seven are peculiar. South temperate America yields only a hundred and eighteen



species, of which only thirty-two are peculiar; while in temperate South Africa we have a hundred and fifty-three species, twenty-one of which are known only from Cape Colony. Temperate North America has only a hundred and fourteen species, thirty-seven of which are confined to that region; while, on the other hand, in temperate Asia, where the fern-flora of the temperate regions attains its maximum, we have "four hundred and thirteen species, eighteen per cent. of the total number, more than half the whole number of species that grow anywhere in temperate regions, twice as many as grow in any other temperate district, more than five times as many as we possess in Europe, and of these, one out of between every three and four is peculiar to it," these being for the most part concentrated in Japan, East China, and the Himalayas.

The accompanying table, which we have adapted from Mrs. Lyell's "Geographical Handbook of all known Ferns," may be found useful as showing at a glance the distribution throughout the world of the European species. The division to which the figures correspond are as follow:—

#### I.—EUROPE AND NORTH AFRICA.

1. Europe proper.
2. Algeria, Madeira, Canaries, Azores.

#### II.—ASIA.

3. Northern, Central, and Western Asia, China, and Japan.
4. Northern India, including Assam, and all north of the Deccan.
5. Southern India, including Concan, Deccan, Orissa, Ceylon.
6. Eastern Peninsula and Archipelago, Philippine Isles.

#### III.—AUSTRALIA AND POLYNESIA.

7. Tropical Australia, New Guinea, Caroline and Solomon Isles, New Hebrides, New Caledonia.
8. Temperate Australia, Tasmania, New Zealand, Auckland Isles, etc.
9. Polynesia, Friendly, Society, Sandwich, Marquesas Isles, etc.

#### IV.—AFRICA.

10. Tropical Africa and Islands.
11. Cape Colony and Natal, Tristan d'Acunha.

#### V.—NORTH AMERICA.

12. Sub-arctic Greenland, Canada, and westerly to the Rocky Mountains.
13. United States, Bermuda.
14. California and New Mexico, British Columbia, covering the slope from the Rocky Mountains to the Pacific.

#### VI.—SOUTH AMERICA.

15. Mexico, Panama, West India Islands.
16. Venezuela, New Granada, Ecuador, Peru, Bolivia, Galapagos Isles.
17. Guiana, Brazil, Paraguay, Uruguay.
18. Chili, La Plata, Patagonia, Falkland Isles, Juan Fernandez.







	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Tribe 6.— <i>Scolopendriæ</i> .																		
Scolopendrium vulgare . . . .	I	2	3	...	...	...	...	...	...	...	...	...	13	...	15	...	...	...
„ Hemionitis . . . .	I	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Tribe 7.— <i>Asplenieæ</i> .																		
Aspidium Lonchitis . . . .	I	...	...	4	...	...	...	...	...	...	...	...	13	14	...	...	...	...
„ aculeatum . . . .	I	2	3	4	5	6	...	8	9	10	11	12	13	14	15	16	17	18
„ angulare . . . .	I	2	3	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...
„ Thelypteris . . . .	I	...	3	4	...	...	...	8	...	10	11	12	13	...	...	...	...	...
„ montanum . . . .	I	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
„ Filix-mas . . . .	I	2	3	4	5	6	...	...	9	10	11	12	13	14	15	16	17	...
„ remotum . . . .	I	...	...	...	...	...	...	...	...	...	...	...	13	...	...	...	...	...
„ rigidum . . . .	I	...	...	...	...	...	...	...	...	...	...	...	...	14	...	...	...	...
„ cristatum . . . .	I	...	...	...	...	...	...	...	...	...	...	12	13	...	...	...	...	...
„ spinulosum . . . .	I	2	...	4	...	...	...	...	...	10	11	12	13	...	...	...	...	...
„ dilatatum . . . .	I	2	3	...	...	...	...	...	...	...	...	12	...	14	...	...	...	...
„ æmulum . . . .	I	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Tribe 8.— <i>Polypodieæ</i> .																		
Polypodium vulgare . . . .	I	2	3	...	...	...	...	...	...	...	...	12	13	14	15	...	...	...
„ Dryopteris . . . .	I	...	3	4	...	...	...	...	...	...	...	12	13	14	...	...	...	...
„ Robertianum . . . .	I	...	3	4	...	...	...	...	...	...	...	...	13	...	...	...	...	...
„ Phegopteris . . . .	I	...	3	...	...	...	...	...	...	...	...	12	13	14	...	...	...	...
„ rhæticum . . . .	I	...	3	...	...	...	...	...	...	...	...	12	...	14	...	...	...	...
„ flexile . . . .	I	...	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Tribe 9.— <i>Grammitideæ</i> .																		
Notholæna Marantæ . . . .	I	2	...	...	...	...	7	...	...	10	...	...	...	...	...	...	...	...
„ lanuginosa . . . .	I	2	...	4	...	...	...	...	...	10	...	...	...	...	...	...	...	...
Gymnogramme leptophylla . . . .	I	2	3	...	5	...	...	8	...	10	11	...	...	...	15	16	...	...
III. OSMUNDACEÆ.																		
Osmunda regalis . . . .	I	2	3	4	5	...	...	...	...	10	11	12	13	...	...	...	17	...
IV. OPHIOGLOSSACEÆ.																		
Ophioglossum vulgatum . . . .	I	2	3	4	5	...	7	8	9	10	11	...	13	...	...	...	...	...
„ lusitanicum . . . .	I	2	...	...	...	...	...	...	...	10	...	...	...	...	...	...	...	...
Botrychium Lunaria . . . .	I	...	3	4	...	...	...	8	...	...	...	12	...	...	...	16	...	18
„ boreale . . . .	I	...	...	...	...	...	...	...	...	...	...	12	...	...	...	...	...	...
„ matricariæfolium . . . .	I	...	...	...	...	...	...	...	...	...	...	12	...	...	...	...	...	...
„ lanceolatum . . . .	I	...	3	...	...	...	...	...	...	...	...	12	...	...	...	...	...	...
„ simplex . . . .	I	...	...	...	...	...	...	...	...	...	...	12	13	...	...	...	...	...
„ ternatum . . . .	I	...	3	...	...	...	...	8	...	...	...	12	13	14	...	...	...	...
„ virginicum . . . .	I	...	3	4	5	...	...	...	...	...	...	12	13	...	15	...	...	...

## THE CULTIVATION OF FERNS.

As we have already observed, few plants have gained so wide a popularity as ferns, on account of the extreme beauty and elegance of their fronds, and the great diversity of form found amongst them; and the European species, to which these pages are devoted, will especially recommend themselves to dwellers in towns, where gardens are, as a rule, very restricted in area, and glass-houses are scarce.

The majority of the ferns indigenous to Europe may be successfully grown in the open air in any part of Britain. Some few species from the most southern parts require protection



but even these thrive admirably and produce a beautiful appearance if they have the protection of a Ward's or window case. Nevertheless, many mistakes are made in the cultivation of these plants, apparently for the reason that this, although not difficult, requires, like most other things, a certain amount of attention. For instance, it is a mistake to suppose that for the cultivation of ferns nothing is required but to give them plenty of water and keep them in the shade. Acting upon this advice, the poor ferns are kept drenched with water until the soil becomes a perfect bog, and they are carefully excluded from even a chance streak of sunshine; the result of such treatment naturally is, that after a short existence they miserably perish. Another mistake into which people fall is based on the theory that ferns require plenty of heat, shade, and moisture; and this is acted upon without the slightest qualification, no matter whether the ferns in question are natives of California or Cochin China, Botany Bay or Bengal. To a certain extent these views are right enough, but they require modification and special application in particular cases, in order that they may be acted upon successfully.

It may safely be laid down as a general principle that moisture in abundance is essential to the well-being of all ferns, but provision must always be made to carry it away quickly, for if allowed to become stagnant about their roots, sickness and death will speedily follow. Again, ferns enjoy shade, but it is quite erroneous to suppose that in a state of nature they grow only in sunless spots, for some of the most delicate kinds are found growing on the sunny side of mountain slopes, although some species do grow most luxuriantly on a northern aspect.

In the matter of heat, even with the strictly tropical kinds, cultivators usually err on the side of excess, the consequences of which are weakly growth and a plague of thrips; for it may be taken for granted that when these insect pests abound, the atmosphere is too hot or too dry, or in all probability both, and the subject of their attacks must at once be removed to a cooler temperature. European ferns generally are easy to cultivate, and yet there are amongst their numbers some few species which are quite as difficult to grow creditably as any in the known world. Amongst these we may enumerate *Asplenium Seelosii*, *A. Petrachæ*, and *A. septentrionale*, *Cheilanthes fragrans*, *Notholaena Marantæ*, and *Ceterach officinarum*, all of which require to be grown with a large admixture of limestone and a sunny exposure. On the other hand, many species grow in very varied situations: on barren spots fully exposed to the influence of the sun and all the winds that blow, or in some deep moist recess, almost hidden from the sun and scarcely ever disturbed by wind. Enough, however, has been said on generalities, and we shall now devote ourselves to a few specialities necessary to the successful cultivation of the ferns of Europe, and in doing so shall place our remarks under four heads, viz., Open Ground Culture, Pot Culture, Wardian Case Culture, and Propagation.

### *Open Ground Culture.*

That ferns display the greatest beauty when thus treated none can deny, but many amateurs are deprived, through want of space, from indulging their tastes in this manner, and must perforce resort to pot culture. With many beginners in fern growing it is considered necessary to have a rockery to grow these plants upon, but why the majority of ferns should be considered to require rock-work it has never been our fate to discover. Such a situation is, we admit, absolutely necessary for the well-being of some few species, but too much weight is often given to the necessity of a good rockery for starting the cultivation of ferns and hardy plants. A well-made and properly planted rockery certainly adds greatly to the pleasure



of a garden, but the majority of small rockeries which have come under our notice have been neither pretty to look at nor suitable for plant life.

The best spot for the construction of an open-air fernery is one with a broken and uneven surface, where there exists a certain amount of shade, protection from wind, and partial exposure to the sun, and if there is a stream of water running through it, so much the better; but there are few amateurs who have such a spot whereon to construct it. These conditions, therefore, cannot be laid down as necessary, but the best must be made of what exists.

The most sheltered spot available should be selected, with partial shade, if possible, but not underneath large trees, as the drip from them is ruinous to the health of most ferns. An elevated site is preferable, because it ensures good drainage, and an uneven surface affords the greatest diversity, and admits of a more artistic arrangement than a flat surface. If such a spot does not exist naturally in the garden, a mound should be thrown up. The base of this should be formed with old bricks, rough stones, or any material that will readily carry away superfluous moisture; over this the soil may be placed, the surface may be diversified, and the soil held in position by masses of stone or rock, if convenient, or by the use of rough burrs, logs, and butts of trees, which should be partially buried. The protruding ends of these may stand in such a manner as to afford some shade to the fronds of the more delicate species, whilst their bases will serve to keep the roots moist and cool during the hottest summer weather. Such a mound may thus be raised to any height, and the outline formed in any shape; the less formality the greater will be the effect, and an unsightly corner may be thus converted into the most effective and pleasing part of the garden. In like manner a blank and unsightly wall may be clothed with verdure by fixing burrs with cement over its surface in the form of pockets, in which ferns when planted will thrive admirably: the only requisites in this operation are to make the pockets with a hole in the bottom to carry away water, and sufficiently large to receive soil for the maintenance of a plant.

The mixture of soil for the fernery should consist of rough peat, loam, leaf-mould, and coarse sand, in about equal parts; this will form a good compost for the ground-work, and in it the majority of the species will thrive, but in planting the most vigorous growing kinds a little extra loam should be placed round them, whilst the more delicate ones will require an addition of sandy peat. The limestone-loving ferns must be accommodated with that article, or the best substitute that can be found in the shape of old mortar or the like.

In planting the fernery care must be taken to properly regulate the plants according to their heights; the tall-growing species must be so disposed that their fronds do not hide the beauties of their dwarfer relatives and neighbours, and those particular kinds which carry their fronds through the winter months should so be distributed amongst the deciduous ones, that the whole may have a furnished and interesting appearance both winter and summer. Little more need be added with respect to the management of the open-air fernery. During the summer, if the weather is dry, the ferns must be kept well watered at their roots, but this should be done in a careful manner, avoiding the too common practice of pouring or dashing the water over the fronds, which is fatal to the uniformity of the plants, and serves no good purpose. In the autumn carefully extract all weeds, and instead of clearing away the fallen leaves, cover them neatly with a thin layer of mould; this not only gives a neat and tidy appearance, but is in other ways preferable to the usual practice of forking between the plants, which we consider very detrimental to the roots.



*Pot Culture.*

The cultivation of ferns in pots enables many to indulge their taste for these plants where neither room nor convenience exists for constructing a fernery in the garden, or even where no garden is at their disposal. The size of the pots in which these plants should be grown must be determined by circumstances. If the space required for their accommodation is of no object, there need be no restriction; but where space is limited, it becomes a matter for serious consideration, and every effort must be made to produce the best possible results from the means at command. Even those so restricted need not despair, as a very creditable and enjoyable collection of ferns may be grown in a comparatively small area.

The soil necessary for growing ferns in pots must be the same as that previously recommended; it will, however, require to be chopped or broken into much smaller pieces, for convenience sake, or it would be impossible to get it into small pots. A sieve should not be used to obtain fine soil, as, although some plant-growers evince a great partiality for sifted mould, it is undoubtedly a great mistake, and we object to its use for anything but seed sowing, and in transplanting young plants from the seed-pans.

Hardy ferns cease to grow in early autumn, continue at rest during the winter months, and will not have commenced growing before the month of April. Early in March, just before the life begins to stir within the crown, will therefore be the best time to repot or top-dress them with new soil. It is sound practice to turn every plant out of its old pot carefully, and if it should not require transplanting into a pot of a larger size, renew or make perfect the old drainage, shake some of the old soil away, and replace with fresh. In this operation, or in repotting, carefully avoid breaking or cutting the roots. We are aware that many consider it quite consistent with good culture, but it is a fallacious argument, as the plant is thus deprived of its support just at the very time of bursting into growth, when all the nourishment its roots can supply is required for the proper development of the fronds.

In repotting avoid giving much extra room, as where very large pots are used the quantity of soil is apt to become sour before the roots are able to occupy it, and when once it has got into this state, not only will the fern roots avoid it, but it extends its baneful influence to that portion already full of roots, and kills them—a fact which soon becomes apparent by the sickly colour of the fronds. The soil being ready, see that the fresh pots are clean and dry. The first operation is draining; this requires a certain amount of care, as very much depends upon the manner in which it is done. Any rough material will answer for this purpose, but broken pots—technically known by the name of crocks and potsherds—are the most convenient and most frequently used. The hole in the bottom of the pot should be first covered with a large crock, with the hollow side downwards, as, placed in this position, the surplus water is most rapidly carried away; above this, for pots of medium size, place about an inch of potsherds broken rather small, but for large pots, where there is a larger quantity of mould to drain, about two inches will be necessary, over the drainage some rough pieces of turf should be laid, to prevent the fine soil from being carried down with the water into the drainage material. After this sufficient of the prepared compost should be put into the pot to bring the crown of the plant up to within about an inch of the rim; this space, or even a little more, should be left available for water. Fill the sides round with soil, pressing it moderately firm, until at last the plant is left with the crown in the centre, and erect; give a moderate watering to settle the new soil, and the operation is complete.

Those ferns having creeping surface rhizomes, such as *Davallia*, *Polypodium*, *Trichomanes*,



*Hymenophyllum*, &c., want very little repotting. They do, indeed, require from time to time additional surface to spread over, but after firmly establishing themselves upon a log of wood, piece of sandstone, or other congenial surface, they become almost, or quite, independent of their base. As we have previously stated, ferns require an abundant supply of water; in fact, at no season of the year must they be allowed to feel the effect of drought, if they are expected to keep in vigorous health and increase in size. In a state of nature many species may indeed, nay, certainly do, suffer considerably from this cause; but the object of a cultivator should be to represent nature in her best form. This is the work the true gardener sets himself to do, and the success which attends these efforts is truly astounding, as our gardens and plant-houses amply testify.

In taking leave of this portion of the subject, we shall simply add that during summer water must be freely given, and during the winter and resting season sufficient must be allowed them to keep the roots of the ferns from perishing.

Those of our fern-loving readers who are the possessors of a frame or pit have it in their power to indulge their taste for the beautiful to a far greater extent than those not possessing such valuable accessories, because many ferns placed under glass retain their fronds through the winter months. When possible, winter the pot-plants in the frame, protecting them from frost until the spring, when they may be again placed in the open air. Those not possessed of a frame should remove the pots to a sheltered corner and plunge them up to their rims in order to prevent frost injuring the roots. The refuse from cocoa-fibre is perhaps the very best material to use; it is light, warm, and very clean. During severe frosts and on sunny days the tops of the plants should be covered with some light material, such as dry bracken, or anything that is convenient. It may appear strange that we advise the covering of the plants on sunny days, but it is of the greatest importance to do this, in order to prevent undue excitement; for plants may be excited into growth by warm sun during the end of February and beginning of March, which is long before all danger from frosts is over, and it is both better and easier to retard growth by excluding the sun's rays, than to try to protect the plants afterwards.

#### *Wardian Case Culture.*

We have already remarked that amongst the ferns of Europe there are some few species from the warm and sunny south which cannot withstand unprotected the severities of an English winter. This difficulty, however, may be easily overcome by the use of glass or Wardian cases, popularly so called in honour of their inventor, Mr. N. B. Ward, who many years ago began the culture of such plants as *Trichomanes* and *Hymenophyllum* in them. Great success attended these first efforts, which led to various improvements, until at the present day they may be obtained of any size or shape, and, when filled with a well grown collection, few objects are more attractive in a dwelling-house.

Like many more important discoveries, the discovery of the Wardian case was due to what is often called an "accident." Mr. Ward had tried in vain to realise what he tells us was "the earliest object of [his] ambition—to possess an old wall covered with ferns and mosses." His rockery, however, "surrounded by numerous manufactories and enveloped in their smoke," was not a success, and the attempt was given up in despair. "I was led," he says, "to reflect a little more deeply upon the subject in consequence of a simple incident which occurred in the summer of 1829. I had buried the chrysalis of a sphinx in some moist mould contained in a wide-mouthed glass bottle, covered with a lid. In watching the bottle from day to day, I



observed that the moisture, which during the heat of the day arose from the mould, became condensed on the internal surface of the glass, and returned whence it came, thus keeping the mould always in the same degree of humidity. About a week prior to the final change of the insect, a seedling fern and a grass made their appearance on the surface of the mould. I could not but be struck with the circumstance of one of that very tribe of plants, which I had for years fruitlessly attempted to cultivate, coming up *sponte sua* in such a situation; and asked myself seriously what were the conditions necessary for its growth. To this the answer was—firstly, an atmosphere free from soot; secondly, light; thirdly, heat; fourthly, moisture; and lastly, change of air." These conditions, with a little management, were found to be supplied by an adaptation of the simple bottle; and from this the Wardian case, which has proved so important an adjunct to the transferring of plants from one country to another.

Filmy Ferns, as the various species of *Trichomanes*, *Hymenophyllum*, and *Leptopteris* are called, require to be grown in a case by themselves, as their delicate, membranous, and pellucid fronds quickly suffer from the amount of air which is necessary for the well-being of a mixed collection of other kinds. The size of case, height of stand, and all such minor details, must be decided upon by the amateur, as so much will depend upon the situation it is to occupy, and the individual taste. The operation of filling the box should be performed in a manner exactly similar to that already recommended for potting; first a layer of drainage, to the depth of about an inch, should be placed over the bottom, to be covered with some rough turfy peat, or what is better, where procurable, a thin layer of living Sphagnum or bog-moss, which does not rot like other mosses; above this put the soil, which should be composed of peat, loam, broken sandstone, and sharp sand, in about equal parts: blocks of limestone and sandstone, in sizes proportionate to the case, should be partially imbedded in the soil, which will serve to diversify the surface, and at the same time afford suitable positions for those species with creeping surface rhizomes.

After the soil is placed in the box the planting must commence. Limestone-loving ferns must be duly studied, and also those with surface rhizomes, whilst *Selaginella helvetica* will form a green and dwarf covering to the whole groundwork; but above all things avoid the too prevalent evil—overcrowding. The planting having been properly finished, the soil must be watered, sufficient being given to settle the whole without saturation, after which the case should be kept closed for a few days, or until the plants begin to show signs of growing and becoming established, when a moderate amount of air must be given every day. On exceptionally hot and dry days the ventilators will be best kept nearly or quite closed until evening. Thus managed the ferns will not require a large quantity of water; indeed, nothing is more detrimental to health than keeping them too wet, therefore the skill of the possessor must be exercised in preserving the happy medium.

A west or north-west window affords a good position for the fern-case, and if the sun's rays should at any time appear too powerful, some light shading material will readily obviate all danger from burning.

It is the custom with many who grow ferns in Wardian cases to replant and renew the soil every spring. With this, however, we cannot agree; we look upon it as destroying the happy arrangement which nature has brought about by the mixture of growth, and unless the soil has become sour, or the plants over-growing each other, we would advise them to be disturbed as little as possible. Therefore, in order to avoid the necessity of disturbing the case annually, it is necessary to observe two rules at starting: 1st, Water carefully; always give enough to well saturate the soil, but leaving no surplus to cause sourness; this can only



be obtained by practice. 2nd, Take into consideration the habit of each species in first planting, so that each may have sufficient space to develop its beauties without crowding out its neighbour in the struggle for life.

### *Propagation.*

This is an interesting operation with all plants, and with ferns especially so, as there are several ways of effecting an increase in numbers. Some species produce small plants upon the upper side of the fronds. In this case the frond must be pegged down upon the surface of the pot, or any other similarly prepared surface, when the little plants will soon take root, and become independent members of the fern world. Others produce bulbils at the apex of their fronds, and these, when detached and properly cared for, rapidly assume the proportions of handsome plants. Again, others have creeping rhizomes and tufted growths; both forms are readily increased by divisions. It is, however, to raising these plants from spores that the greatest interest is attached, and that the greatest amount of trouble and care is necessary.

In setting about this, the first necessity is a fertile frond; this should be secured before the spore cases have opened. Wrap it carefully in a large envelope, and place in a warm position for a few days; by this time the cases will have burst, and the spores should at once be sown. By this method the operator secures the spores; but in many instances the fronds are left on the plant until the spores have all floated away, and only spore cases are sown, which are just as capable of producing a crop of ferns as empty pods of peas would be of producing a crop of that vegetable.

The pots for sowing the spores in should be well drained, and filled to within about two inches of the rim with rather stiff loam, which has been previously baked, the whole pressed down firm, and thoroughly soaked with water. After the water has passed away the spores must be carefully dusted upon the surface, and a piece of glass or a bell-glass placed over them. Nothing more will be necessary but to keep the soil in as near the same state of moisture as possible until the spores germinate.

Baked soil is preferable for raising ferns, on account of that process killing all seeds, worms, or anything obnoxious which would escape detection, small worms being specially troublesome amongst young ferns. It may be a matter of surprise that we recommend stiff loam for these plants in their most delicate stage or period of life; this, however, is the teaching of experience. We have tried various soils for this purpose in the course of our practice, and have invariably had the greatest success and returns from pure loam. This probably arises from the fact of its preserving a more uniform degree of moisture than any lighter kinds; but the young ferns do not like stiff loam long, and as soon as they begin to make little fronds they are best transplanted into the compost already recommended for the mature plants.

There is a great deal of uncertainty respecting the length of time the spores of different species take to germinate; some commence to grow in a few days, others require weeks, whilst some will remain dormant for twelve months. It is best to arrange, if possible, that the spores do not begin to germinate late in the autumn, as they are very apt to damp off through the winter months. If the young plants are very much crowded, as in all probability they will be, remove them with a sharp-pointed stick in little clumps, and transplant them into other pots where they will have room to spread. If this is not done, the probability is that more than half their numbers will perish. This thinning should be repeated as occasion may require until they make fronds and are sufficiently large to be placed singly in small pots. Up



to this time the young plants require great care and attention in the matter of water and air, but after a few fronds are developed, they will conform to the ordinary treatment.

Fern spores germinate most rapidly in a close, moist, and warm atmosphere, and those wishing to raise them without such convenience will find a Wardian case or a close cool frame the next best resource. But under these conditions very few other than species from temperate regions will be likely to germinate, and they will remain dormant a much longer time than when sown in heat.

The ferns of temperate regions appear to be well-nigh exempt from the insect pests their tropical relatives are subject to; occasionally, however, they suffer from the attacks of thrips, which, feeding upon the cuticle, very soon render the plant unsightly; this is a sure sign the plant is suffering in health, most probably from being in a situation both too hot and dry. Again, brown scale shows itself at times, but this is usually when the ferns are grown in a vinery with other plants to which the parasites really belong. In summer also the young fronds take the fancy of the green fly, but this is not of frequent occurrence. The scale must be carefully picked off when seen, and a little fumigation with tobacco will soon induce the other pests to desert.

Besides insects, however, there are other enemies to hardy ferns, to which the genus *Zonites* contributes several members, *Z. alliaria*, *Z. cellaria*, and *Z. purus* being the most destructive. These small snails, combined with several of the slugs, such as *Limax flava*, *L. agrestis*, *L. variegatus*, and some others, must be sharply looked after, in the open-ground fernery especially, or they will commit sad havoc amongst the choice and rare kinds. Hand-picking in the early morning and in the evening will materially assist in clearing out these marauders, whilst some tender lettuce leaves will entice others from their lurking-places, where otherwise they might elude the most vigilant observer.

#### ECONOMIC PROPERTIES.

When we state that the economic properties of ferns are for the most part "conspicuous by their absence," we may seem to lay ourselves open to a charge of plagiarism; as it may be thought that we are imitating the old author who, having headed a chapter "Of the Snakes of Iceland," began and ended it with the concise statement, "There are *no* snakes in Iceland." But although it cannot be asserted that the useful properties of this group of plants are of such importance as to entitle the ferns to consideration on this ground, and although no one species stands out prominently as of value to mankind either from its medical or economic qualities, we shall nevertheless find—as, indeed, is only to be expected in a group including so large a number of species—that some of them have attained at any rate a local reputation, and have been employed in various ways for the benefit of mankind. Like the peacock in the old fable, whose beauty compensated for the harshness of its voice, the elegance and gracefulness of ferns is quite sufficient to entitle them to a high place in our regard; and it may be remarked that the members of one of the most popular groups of cultivated plants, the *Orchidaceæ*, with all their quaint variety of form and richness of colour, are equally remarkable for the absence of any markedly useful qualities. It would, indeed, demand no very great effort of the imagination, no very daring flight of fancy to suppose that the law of compensation works to some extent in the vegetable world; at any rate it is certain that while such important groups of plants as the Cross-bearers (*Cruciferae*), Umbellifers (*Umbelliferae*), and Grasses (*Gramineæ*), from which we obtain so many of our most important vegetables, and to the last-named of which we are indebted for all



the various cereals which go to make up the staff of life—are, for the most part, in no way remarkable for the elegant form or beautiful colouring of their blossoms, we find, on the other hand, that some of the most handsome families—such as the *Liliaceæ*, with all its wealth of lilies, hyacinths, and allied plants, the *Bignoniaceæ*, with its beautiful showy-flowered climbers, which form so prominent an object in the tropical forests of the Eastern Hemisphere, and the before-mentioned *Orchidaceæ*—are comparatively destitute of economic properties. It would, of course, be easy to point out instances in which beauty of form was combined in the same family with great economic importance—as, for example, in the noble tribe of palms: but to descend from the general to the particular, from the vegetable world at large to the small section of it with which we are more especially concerned, we shall find that the uses to which ferns have been applied, if not of notable importance in any special case, are very varied. Our British species, indeed, include among their number many of those to which real or fancied qualities and uses have been attributed; and when we come to consider each of these in the descriptive portion of our book, we shall find that numerous, if not important, qualities have been ascribed to them. In the case of the Bracken (*Pteris aquilina*), for example, we shall find that it is, or has been, employed in all kinds of ways—economic, medicinal, and superstitious. The rhizome and the young fronds have been eaten; alkali is obtained from its ashes; it has been used in common with so many other ferns as an anthelmintic, and in many other ways more or less connected with medical practice; while the “receipt of fern-seed,” by which men were wont to “walk invisible,” is or has been—for it must be confessed that such superstitious beliefs are becoming very rapidly things of the past, although, like errors and fictions of greater moment, they certainly die hard—very generally believed in; although nowadays most people would be found to agree with Chamberlain (*Henry IV.*, Part II., act ii., scene 1) that “you are more indebted to the night than to fern-seed for walking invisible.”

There is, indeed, a good deal of that kind of fiction for which the name “folk-lore” is nowadays found a convenient title, which is more or less intimately connected with ferns; but as this is more especially the case with reference to some of the commonest European species, the discussion of the subject may for the most part be more suitably referred to under the plants with which the traditions are more especially concerned—notably the Bracken, the Male Fern, the Flowering Fern, and the Moonwort.

We hardly know enough of the popular history of ferns in extra-European countries to say whether as much tradition or folk-lore attaches to them; and records of this kind of popular fiction are somewhat rare. We learn, however, that in New Zealand a species of *Asplenium* (*A. lucidum*) is regarded by the natives with reverence, and considered by them as a sacred plant. Dr. George Bennett tells us that it is used by the Tohunga or priest when he is praying over a sick person and endeavouring to avert the anger of the gods, to whose influence the illness of the individual is attributed; he waves a frond of this fern over the patient, and should it happen to break, it is regarded as a fatal omen. When the Tohunga consults the gods, previous to engaging in any war enterprise, he also waves a frond of this fern whilst he offers up prayers to the spirits; if it breaks, it is supposed that the gods are adverse to their engaging in war, and the enterprise is abandoned. It is also used by the natives as a badge of mourning: when a wife mourns for her husband, she sits wailing in her hut, with a frond of this fern bound as a fillet round her head; and a husband performs the same ceremony when he loses his wife. They are careful not to burn the plant. It is also employed when a chief has his hair cut: after the operation is



performed, he holds a frond in his hand; meanwhile the priest prays over him, taking the frond and shaking it; after which it is dipped in water and shaken over the chief; if it breaks, it is regarded as a sign that he will not live long; if one of the leaflets should break off, it is regarded as an omen that one of his family will soon die; but should the frond remain entire during the ceremony, it is considered as an indication of health, success, and long life.

Our common Male Fern (*Aspidium Filix-mas*) has really some claims to be considered of importance from an economic point of view, inasmuch as it finds a place in the British Pharmacopœia. There seems to be no doubt that this fern has been very efficaciously employed in the treatment of tape-worm, a use for which it has been in repute since the days of Dioscorides. From time to time the Male Fern has been the principal ingredient in certain important medicines which had attained great celebrity as vermifuges; and, as we shall see further on, the secret of these medicines has been purchased at a high price by more than one European sovereign, presumably with the intention of promulgating so wonderful a remedy among their subjects. The Polypody (*Polypodium vulgare*) was formerly employed as a purgative, and also in cases of coughs and pectoral affections; and in country places is, or was until lately, used as a remedy in cases of whooping-cough. In the curious old names Miltwaste and Tentwort, for *Ceterach officinarum* and *Asplenium Ruta-muraria* respectively, may be found indications of the disorders in which they were supposed to be efficacious. The former was thought to be a cure for the "swelling of the spleen," to which we also owe the common name Spleenwort, now usually applied to the *Asplenium*: while the latter was so called from its employment in cases of rickets—a disease formerly known as "the taint." For this complaint the Royal Fern (*Osmunda regalis*) is still a popular remedy in some parts of Cumberland. In Westmeath the Hart's Tongue (*Scolopendrium vulgare*) is employed as a popular remedy for burns. The Adder's Tongue (*Ophioglossum vulgatum*) was collected until quite recently for use in making a healing ointment called Adder's Spear Ointment—a practice which probably still lingers in country districts, where herbs are frequently employed as remedial agents, and it must be admitted sometimes with signal success. Indeed, a little inquiry in a rural district will usually bring to light some herb-remedy which has been handed down from a remote period, and still holds its own among a rural population. We were much struck a few years since at finding an ointment made from the Clown's Woundwort (*Stachys palustris*) employed by a village woman in Buckinghamshire with very satisfactory results. Gerard, who gave the plant its English name, tells us he did so because of "a clownish answer" which he received from "a very poore man," who had cut his leg to the bone and healed it with this plant. Gerard tells us he "offered to heale the same for charitie, which he refused, saying that I coulde not heale it so well as himselfe." The Comfrey (*Symphytum officinale*) is another common British plant which undoubtedly possesses the healing and consolidating properties to which it owes its old names of Consound, Knitback, Bruisewort, and others. Gerard, indeed, says that the roots "are so glutenative that they will sodder or glew together meat that is chopt in pieces seething in a pot;" but whether this be the case or not, it is certain that some fifty years since a Mr. Rootsey published an account of a workman who had broken his leg, and who, after four years' confinement to his room, was healed by the application of Comfrey as a poultice; splinters of bone were brought away, and in a few weeks he was able to walk. Mr. Oswald Cockayne, in the interesting preface to his "Saxon Leechdoms," gives another instance of the beneficial employment of Comfrey. He says, "Perhaps herbs

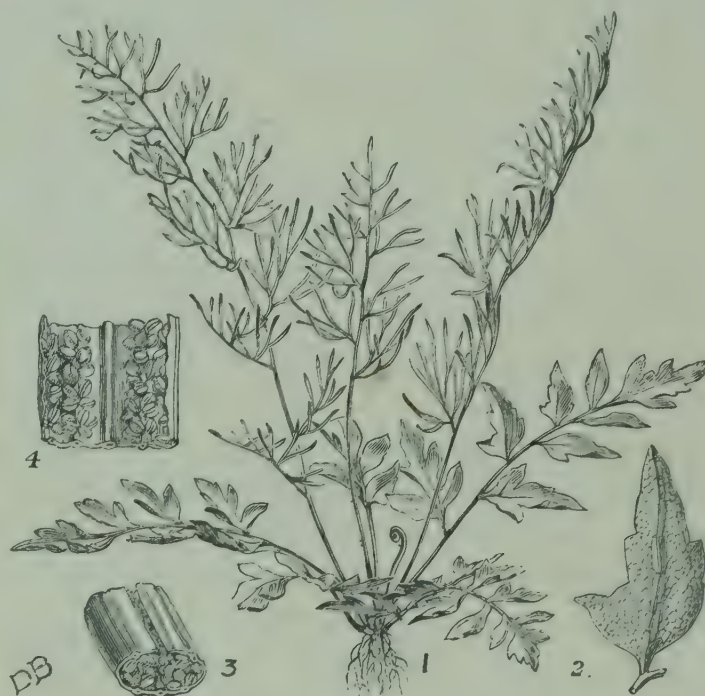


are more really effectual than we shall easily believe. The locksmith at Teddington told me that he had broken the bone of his little finger, and for two months it was grinding and grunding, so that he felt sometimes quite wrong in himself. One day he saw Dr. — go by, and told him. He said, 'You see that there Comfrey; take a piece of the root, and clean it, and put it to your finger, and wrap it up.' The man did so, and in four days his finger was well. This story struck me the more since the Comfrey is the *confirma* of the Middle Ages and the *σύμφυτον* of the Greeks, both which names seem to attribute to the plant the same consolidating virtue." But it is time to return to our ferns, from which we seem somehow to have strayed.

A few other properties of our ferns will be considered when each species is described at length; but it must be admitted that when all is said that can be brought together regarding them, the useful qualities of the group are by no means conspicuous, and the same may be said of the extra-European species.

Even when useful properties exist, they are by no means striking. Speaking generally, we may say that the fronds of ferns, when they possess any distinct properties, are mucilaginous and slightly astringent, while the rhizomes are in many cases bitter, astringent, and rather acrid; both the rhizomes and stems of many species abound in starch. If active beneficial properties are absent in any marked degree, it is pleasant to find that there is an equal absence of noxious qualities; so far as is known, we have no example of a poisonous fern.

Besides the European species, we may enumerate a few which are employed in some way either in medicine or commerce. Beginning with such as are used as food, the soft mucilaginous pith of *Cyathea medullaris*, one of the large tree-ferns of New Zealand, was formerly eaten by the natives; it is of a reddish colour, and when baked acquires a pungent taste, somewhat resembling that of the radish. In New Caledonia another species of *Cyathea* (*C. Vieillardii*) is similarly employed, the mucilaginous matter being obtained by means of incisions made in the stem or at the base of the fronds. In New Zealand, indeed, ferns seem to be in some repute for their edible properties; the large, swollen, scaly rhizomes of *Marattia fraxinea*—a widely-distributed Old World fern of coarse habit, having large twice or three times pinnate fronds with fleshy stipes—are also eaten by the Maoris. The rhizomes of another New Zealand fern, *Pteris esculenta*—a fern nearly allied to, or perhaps only a form of, our common Bracken (*P. aquilina*), which, as we shall see, has itself been employed as food in more ways than one—serve as food to the natives, who roast them in ashes, peel them with their teeth, and eat them with meat as we do bread. This custom, however, like so many others of aboriginal growth, has become to a great extent obsolete. Forster speaks of the New Zealanders as pounding the previously roasted fern-roots between stones, in order to extract the nutritious matter, the woody portion being rejected as useless. In Nepaul the rhizomes of *Nephrolepis tuberosa* are similarly employed.



CERATOPTERIS THALICTROIDES.

1. *Ceratopteris thalictroides* ( $\frac{1}{4}$  nat. size).
2. Under surface of barren pinna ( $\frac{3}{4}$  nat. size).
3. Section of part of fertile pinna (4 times nat. size).
4. Section of part of do. laid open (4 times nat. size).



The succulent fronds of the curious little Water Fern (*Ceratopteris thalictroides*) are boiled and eaten as a vegetable by the poorer classes in the Indian Archipelago. This species, which is figured on the preceding page, is remarkable on account of its aquatic habit, in which respect it is quite exceptional among ferns. It is an annual species, found in wet places, or floating upon shallow, slowly-moving waters in the tropics of both hemispheres. It has much divided, succulent, membranous fronds, which are often proliferous; the sterile ones are leafy and less divided, with reticulated veins, the fertile fronds being taller and divided into very narrow segments. It has been grown in the Victoria tanks at Kew. Small as it is, this little fern has had at least as many names as a Spanish grandee, having been described by no less than twelve authors under as many generic and specific names.

The young shoots of a handsome tree-fern, *Angiopteris evecta*, are eaten in the Society Islands; the large rhizome is in great part composed of a mucilaginous matter, from which, when dried, a kind of flour is prepared. In the same islands the young fronds of *Helminthostachys scylanica* are prepared and eaten in the same way as asparagus. The young fronds of *Alsophila lunulata*, the "Balabala" of the Fiji Islands, are eaten in times of scarcity; and the soft scales covering the stipes of the fronds are used for stuffing pillows and cushions by the white settlers in preference to feathers, because they do not become so heated, and are thus a real luxury in a sultry tropical night. In New South Wales the thick rhizome of *Blechnum cartilagineum* is much eaten by the natives; it is first roasted, and then beaten so as to break away the woody fibre; it is said to taste like a waxy potato.

The syrup "capillaire," which is a popular French pectoral remedy, is prepared from the Maidenhair (*Adiantum capillus-veneris*); the North American *Adiantum pedatum* possesses similar properties, which are less conspicuously displayed in the Wall Rue (*Asplenium Ruta-muraria*) and Black Maidenhair (*Asplenium Adiantum-nigrum*). To these we shall refer more particularly when we come to speak of the genus *Adiantum*. In Peru the rhizomes of two Polypodies (*Polypodium Calaguala* and *Polypodium crassifolium*), with those of *Acrostichum Huascaró*, are employed under the name of Calaguala as diaphoretics and astringents: febrifugal and anti-rheumatic virtues are also ascribed to them. The drug has been brought to Europe, although but rarely; and there is some doubt as to whether the ferns just mentioned have really produced the specimens imported under the name Calaguala. The fronds of *Aspidium fragrans*, which have a pleasant scent resembling that of raspberries, are much esteemed in Northern Asia as an anti-scorbutic, and in Mongolia are used as a substitute for tea. The hairs of a species of *Dicksonia* (*Cibotium*)—nearly allied to, and perhaps identical with, the *Dicksonia Barometz* which we have considered at some length when treating of the genus—have been employed as a styptic, and even find a place in the German Pharmacopœia; but their action seems to be purely mechanical, although some practitioners have tried the effect of an aqueous decoction of them in cases of internal hæmorrhage, and in some instances favourable reports have been issued. The drug is exposed for sale in the markets of Java under the name of Penghawar-Djambi, and is occasionally met with at the public drug sales in London. It is imported in the form of straight pieces of the lower part of the stem of the fern, about a foot in length and an inch in width; their most striking feature being the abundance of the long sparkling golden hairs with which they are thickly covered. It is chiefly sent to Java from Sumatra, but also from China, Borneo, and the Philippine Islands. This fern is not a native of Java, but the inner portion of the stems of an indigenous fern, *Balantium chrysotrichum*, are employed as a substitute for the true Penghawar-Djambi, under the name of Paku-Kidang. This substitution is said to have been first made by the Dutch in 1837, and it is this which has been



usually brought to Europe as a styptic. The Pulu of the Sandwich Islands consists of similar hairs of *Cibotium glaucum*, and allied species.

The bruised fronds of *Angiopteris evecta* are used in the Pacific Islands, with those of *Polypodium phymatodes*, for imparting an agreeable odour to cocoa-nut oil; and the oil thus prepared forms the basis of a liniment which is largely employed by the natives against rheumatic pains. An elegant and fragrant South African fern, *Mohria thurifraga*, is somewhat similarly employed, being used in the manufacture of an ointment which is found useful in burns and similar cases. The densely clothed rhizomes of a species of *Davallia* are used in China in medical practice; there are specimens in the herbarium of the British Museum from an apothecary's stall at Ningpo. *Nothochlæna piloselloides* has been used in India to subdue sponginess in the gums.

The trunks of some of the tree-ferns, such as the New Zealand *Cyathea medullaris*, and *Alsophila excelsa*, in Norfolk Island, are used in building; while the fronds of *Acrostichum aureum* are commonly employed for thatching in the coast districts of the Isthmus of Panama. In the Fiji Islands another *Alsophila*, *A. lunulata*, the "Balabala" of the natives, which attains the height of twenty-five feet, and forms an imposing feature in the landscape, is much used in building, the trunks being not only extremely durable, but also to a great extent fire-proof. Dr. Seemann states that the little sticks which the chiefs carry stuck under their turban, and with which they scratch their heads, are also made of Balabala. He says: "The trunks make excellent posts, lasting an incredibly long time, and possessing moreover the advantage of being almost fire-proof. After a house has been burnt down, they are almost the only trace that remains. It is also customary to make the ridge-pole of houses and temples of this tree-fern, and to surround it with the Wa-Kalou (holy creeper), a species of that curious genus of climbing ferns, *Lygodictyon*—partially, no doubt, from some superstitious notions, but partially also to keep out the wet. The trunk of the Balabala, cut into ornamental forms, is frequently observed around tombs, temples, bures, and churches, presenting a pretty effect." The tubes of the pipes of the Brazilian negroes are made from the stipes of *Mertensia dichotoma*, which they call "Samanbaya."

#### THE FERN HERBARIUM.

A Fern herbarium is, perhaps, more easy to make, and more satisfactory when made, than that of any other class of plants, except possibly Mosses. Some groups, indeed, such as the Fungi, it is almost impossible to preserve in any even approximately satisfactory manner; others, such as the Lichens, are readily preserved—indeed, they may be said to preserve themselves—but it can hardly be said that they form an attractive-looking collection, and moreover they are somewhat cumbrous, as they are not always readily to be removed from the rocks or stones upon which they grow. Then as to flowering plants: it is true that the professed botanist troubles himself very little about such trifles as colour, and even form is not greatly attended to by him, but the amateur may be pardoned if he regards a herbarium as partaking a little of the nature of a hay-stack, while the "things of beauty" of which it is composed can assuredly in no sense be regarded as "joys for ever." In spite of all efforts to the contrary, and of all the means proposed to avert the evil, the colour *will* fly from blue flowers; yellow ones—such as Primroses, Bird's-foot Trefoil, and the like—sooner or later assume a bright green hue, and such delicate pieces of colouring as the Spotted Orchis become of a uniform brown tint. Other objectionable peculiarities might be mentioned—



such, for instance, as the persistent growth of the Stonecrops in spite of the heaviest pressure, and the equally persistent shedding of their leaves if, as a last resource, boiling water is resorted to. Then there are plants with thick woody stems which are by no means elegant objects; and there are water plants which collapse when taken out of the water, and refuse to flatten themselves out again; some plants dry very quickly, and rot if allowed to remain too long in the press, others seem as if they never intended to dry at all; and so we might go on with a catalogue of grievances, all of which are more or less familiar to any one who has made a herbarium, especially if he has made up his mind that his herbarium should be not only useful, but also ornamental.

With ferns many of these difficulties are entirely avoided. Not only their natural grace of form, but also their natural beauty of colour, is preserved, and that almost without an effort. It is no wonder, indeed, that the fronds are pressed into service for all kinds of ornamental work, of which the latest manifestation seems to be the invention of a series of Christmas and birthday cards, which are bordered or otherwise embellished with the pinnules of ferns. The fronds should be collected on a dry day; some advocate drying them, as also other plants, in the field, but this method, although it has its advantages, always seemed to us open to criticism, for a very small amount of wind will effectually prevent any steady effort in this direction by the liberties which it takes with the drying-paper. But some ferns—notably the Lady Fern and the young stage of the Bracken, and indeed nearly all the species when young—will soon wither up if carried in the warm hand, so that it is best to take a tin box of some kind when going on a collecting expedition. It must be a long box, or the fronds will get bent, and once thus disfigured they will not soon recover their pristine elegance. When it is possible to exercise a choice in the matter, it is best to choose a dry bright day for collecting; if the fronds are wet when gathered they will require much more drying; and it should be remembered that, other things being equal, plants dried rapidly keep their colour better than others which are allowed to remain for any long time in the press. In the same way, it is best to take them straight from the collecting-box to the press, without first putting them in water—except, of course, when this is necessary to enable them to regain their shape. Plants can be left for two or three days, or even longer, in the box without taking any harm, if the box itself be kept in a cool place away from the light. A kind of thick, rough, bibulous paper is prepared for drying purposes, and is much used, especially by amateurs, but any old paper will do as well, such as newspapers—an old music-book makes a capital press; and newspapers do not require drying so often as the drying-paper, which absorbs the moisture so rapidly that care must be taken (when plants are many and the stock of paper is but small) to prevent its becoming so saturated as to damage the specimens and encourage the growth of mould. Newspapers, too, are not only less expensive, but also less cumbrous to carry about; and though old ones are preferable, even a recent newspaper may, on an emergency, be pressed into the service with satisfactory results. A press of the size of the paper is often used, consisting of two thin boards, between which the paper is placed, the whole being bound together by a couple of leather straps, and then put under a heavy weight, care being taken that the pressure is equal and not too great. There is, perhaps, less danger of injuring ferns by over-pressure than is the case with flowering plants, on account of the firmness of their texture; but it is only by experience that we can attain the “happy mean,” and adjust our weight so that it shall be sufficient to insure a thorough even pressure throughout, neither so heavy as to run any risk of destroying the character of the frond, nor so light as to allow it to lie otherwise than completely flat.



In the selection of specimens for the herbarium some care is required, as it is important that each plant, so far as possible, should be represented in all its parts and in its various stages. Of the smaller ferns, such as the *Aspleniums*, Moonworts, Adder's-tongue, and the like, the whole plant should be shown; by this means it will, in many cases, be easy to secure upon one and the same specimen fronds in different stages of growth, some being arranged so as to show the upper and others the under surface; the mature fructification being always represented. Of larger species, such as the Male Fern, it will not be possible to take the whole plant; here a couple of representative and fully-developed fronds, showing the upper and under sides, must suffice. It will be impossible to show even a single entire frond of such ferns as the Bracken or Flowering Fern; a pair of pinnæ with the apex, or, in the latter case, the fertile portion of the frond, will however give a fair idea of the plant. Variations in the size and form of ferns, however caused, may well be represented in the herbarium; the common Hart's-tongue, for example, is strikingly different when it puts forth small, stunted, but mature fronds from the crevices of an old stone wall, from the same fern when it sends out long bright green fronds from some shady hedge-bank, or from the mossy border of some old well. Most ferns growing on or rather in walls are reduced to their very smallest proportions under such unfavourable circumstances; indeed, it is often a marvel how they manage to exist at all in a position so unsuitable to their full development. Then we often find, as in the Hart's-tongue, curiously curled, or forked, or variously divided fronds, some of which become permanent, and are reproduced from spores; or variations in the toothing of the margins, such as are noticeable in some of the more striking forms of the common Polypody; these, too, must find a place in our collection, which will in this manner be made very instructive, and far more interesting than would be the case were we content with a solitary example of the ordinary typical state of the fern. When it is possible to secure a seedling, or very young state of a fern, it is quite worth while to do so; in the Bracken, for instance, as we shall see later on, the young state is so different in appearance from the mature plant that it has even been described as a distinct species. But undeveloped and barren specimens have led to many mistakes in identification; any one who has had experience in naming collections of ferns knows only too well the kind of specimens with which well-meaning amateurs torture their friends—the small seedlings of Male Fern which they attempt to transform into *Cystopteris*, or the immature Shield Fern, which “must surely be the true Holly Fern, it is so very like the pictures of that plant.” He who is wise will be careful before he commits himself to naming ferns of which the characteristic fructification is not developed. “By their fruits ye shall know them” is a text which the botanist will do well to bear in mind when he is appealed to, to determine some doubtful flower or fern. The rhizome, or underground stem, of some species should be carefully dug up and represented in the herbarium—as, for example, in the case of the Marsh Fern (*Aspidium Thelypteris*), of which the long creeping rhizome is very characteristic.

The size of the specimens we select for our fern collection must, of course, be regulated by that of the paper upon which we intend to mount them. In Continental herbaria, indeed, plants are less frequently mounted than placed loose in a folded sheet of paper, but our English custom is to mount them in some way upon sheets of stiff paper. In the British Museum Herbarium the great fern collection is laid down upon paper measuring twenty-one inches by thirteen, this being an especially large size, intended to allow of a more satisfactory representation of the larger species than is possible when smaller sheets are used; but it will generally be found that sheets sixteen inches by eleven or so are amply sufficient for all



practical purposes. We may, if we please, either attach our specimen firmly to the paper by gumming it all over on the under side, as is done in the British Museum—the gum used being a mixture of tragacanth and gum arabic in equal proportions—or we may fasten it to the sheet by means of gummed strips of paper (which, by the way, will be needed in the former case for the ends of the stems); the advantage of this latter system is, of course, that the specimen so fastened can, when necessary, be transferred from one sheet to another without injury. Some have adopted the plan of sewing the fern to the paper; the appearance of specimens so arranged is very neat, but the process is rather tedious, and not unattended with danger to the specimen, so that we do not recommend it for adoption.

The sheets being thus duly prepared, the next question is—how to arrange them. First, however, the specimens must be labelled, each label supplying the name of the fern, with the locality where it was found and the date when it was collected, adding also the collector's name and any other information relative to the specimen which may be of special interest. The plan which is adopted by many botanists of writing all necessary information upon the sheet itself is a very good one; some, however, prefer a uniform series of labels, and the following form will be found simple and useful for the purpose:—

HERB. JOHN SMITH.

*Pteris aquilina*, L.

Bracken.

LOC.—Hampstead Heath, Middlesex.

DATE.—June 12, 1876.

COLL.—John Smith.

For purposes of ready reference the sheets should be arranged in stiff covers of somewhat stouter paper than that upon which the specimens are mounted. The name of the genus may well be written in the bottom left-hand corner; in the centre may be noted a reference to the manual or list by which the ferns are arranged, while the names of the species may be written in the right-hand corner. Should the ferns be represented by more than one sheet, it may be convenient to enclose each species in a cover of thinner paper, writing the name in the right-hand corner. The herbarium must, of course, be kept in a dry place, as damp favours the growth of mould. If there is any fear of the attacks of insects, it is well to wash the specimens over with a solution of corrosive sublimate; the solution in use at the Kew Herbarium is composed of one pound of corrosive sublimate and the same quantity of carbolic acid to four gallons of methylated spirit; this is found very efficacious, but its smell is somewhat unpleasant. At the British Museum it is found that camphor kept in each cabinet, and frequently renewed, is sufficient to prevent the appearance of insects in the herbarium.

Last of all comes the question—Where and how shall we keep our ferns when they are in a condition to be consulted; when collecting, and naming, and drying, and mounting are









STRUTHIOPTERIS GERMANICA. (Willd.)

( $\frac{1}{2}$  NATURAL SIZE)

2. UPPER SURFACE OF FERTILE PINNA. 3. UNDER SURFACE OF FERTILE PINNA. 4. UNDER SURFACE OF STERILE PINNA.



# EUROPEAN FERNS.



## ONOCLEA.



THIS is a small though handsome genus, containing only three species, natives of cold or temperate regions. *O. sensibilis*, the type of the genus, is a common North American fern, which is found also in Northern Asia, Mandschuria, and Japan; it is frequently met with in cultivation, having been known in this country as long ago as 1699, when it was grown by Bobart in the Oxford Botanic Garden. It has been erroneously recorded as a British plant, being said to grow in North Yorkshire and near Warrington, Cheshire (see "Phytologist," i. 492). The note announcing its discovery stated that in the latter locality it grew plentifully and very luxuriantly in an old stone quarry, having been first found there about 1839. There is a Warrington specimen in the British Herbarium of the Botanical Department of the British Museum, communicated by the late Mr. Borrer, but it is there described—no doubt with greater accuracy—as "naturalised in boggy ground, near the site of a former garden." This attempt to raise the number of our indigenous species has been paralleled, as our readers will remember, by the pseudo-discovery of the Elk's-horn Fern (*Platycerium alcicorne*) upon Cader Idris. *O. sensibilis*, the "Sensitive Fern" of American authors, is a handsome plant, the leafy, pinnate, barren fronds being much taller than the fertile ones, the latter being twice pinnate. The barren fronds vary from four inches to three feet in height, and are so thin and delicate in texture that it is said that they will wither even while growing if drawn once or twice through the hand; hence the specific name *sensibilis*. With this plant are now associated two other species, better known under the name of *Struthiopteris*, and differing chiefly from it in the simply pinnate fertile fronds, and in having the veins of the barren fronds all free. One of these, *O. orientalis*, is a native of Sikkim, Assam, and Japan; the second, *O. germanica*, we shall now proceed to consider somewhat at length.

### ONOCLEA STRUTHIOPTERIS, Hoffm.

This is the largest and handsomest of the ferns of Europe, and, indeed, has some pretensions to be considered a tree-fern. This results from the caudex forming an upright thick trunk, which, however, never attains to any height, reaching at most to three-quarters of a foot: still,



in nature and construction it is precisely like the large stems of the tree-ferns of tropical and sub-tropical countries. From beneath the surface of the ground the caudex gives off stolons, which run for seven or eight feet, and propagate the plant.

The fronds are of two kinds—barren and fertile, the latter bearing the sori. The barren fronds are very numerous, and form a magnificent vase-shaped crown of foliage of very regular arrangement. They are of large size, sometimes attaining a length of as much as five feet, though usually about three feet, and are elegantly curved outwards. The petiole is short, and is dilated at the base, where it joins the stem, and there covered with nearly black scales, which are not torn or lacerated; on section, the petiole presents two oblong curved vascular bundles.

The general form of the frond is broadly oblong, gradually diminishing in width at the base, and abruptly narrowed at the apex; it is divided into very numerous pinnæ. These are all sessile; the lower ones are small and distant, usually turned downwards, and at the very base of the petiole become brown and scale-like; the main pinnæ are four or five inches long, narrow, slightly curved towards the apex of the frond, and tapering to the point; they are very numerous, and vary considerably in proximity to one another, being usually just in contact but not unfrequently so closely placed that they overlap. Each pinna is simply cut into numerous, simple, oblong, blunt segments, which are not again divided or toothed. The general appearance of the whole frond is not unlike that of the common Male Fern, but it is a paler and brighter green. The venation of the segments of the pinna is remarkable in being quite simple, not forked or reticulated.

The fertile or sporiferous fronds are few in number, usually from three to six; they appear in the centre of the tuft in the autumn, and are not mature till September and October. Their height is not more than eighteen inches or two feet, and they are erect and straight, with a stout, stiff rachis, broader and flatter than in the barren fronds, deeply channelled in the lower portion. The pinnæ are very numerous, and crowded closely together; in fact, the whole frond is a much contracted form of the barren ones. The large pinnæ are about one-and-a-half to two inches long, but the upper and lower ones much shorter; all are sessile and directed upwards, and are dark brown in colour. In outline they are narrow linear, obtuse at the apex, and with a rather knotted appearance, each knot corresponding with a segment; in substance they are nearly cylindrical, the margin being rolled in underneath and covering over the sori. The venation is simple, the central vein of each segment giving off several undivided veinlets on each side, and upon the middle of every one of these is borne a sorus. The sori are round and confluent into a mass, the receptacles very thick and cylindrical. It was long considered that no indusium was present; but this integument is now known to occur as an exceedingly delicate membrane over each sorus, separating it from its neighbour. The spores are oval and yellow. Occasionally fronds are met with intermediate between the barren and fertile condition, bearing a few sori as contracted though still herbaceous pinnæ.

There is little variation in this fine fern, and no forms are sufficiently distinct to have received separate names. The plant itself has, however, been very unfortunate in this respect. It is the *Osmunda Struthiopteris* of Linnæus, who thus placed it in a genus where it is impossible to retain it. The German botanist, Hoffmann, transferred it to the genus *Onoclea* as *O. Struthiopteris*; in cultivation it is generally known by Willdenow's name for it, *Struthiopteris germanica*. The separate genus *Struthiopteris* is distinguished from *Onoclea* by the simple venation of the barren fronds. The plant has several more names.



This species has an extensive range in the northern hemisphere, extending round the globe in the cold latitudes of Europe, Asia, and America. It grows in shady places, moist meadows, and the sides of streams. In Europe the preference of this species for cold climates is very evident. It grows in Lapland within the Arctic circle, in Norway, Sweden, Denmark, Prussia, the Baltic provinces, Northern and Central Russia abundantly, and Poland. In Central and Southern Europe it is much less frequent, though it occurs in Baden, the Vosges, Piedmont, North Italy, South Tyrol, Bohemia, and some other places. In Western Europe it is unknown, and it is not found in France, the British Isles, or the Spanish Peninsula. In the East it extends as far south as the Crimea and the Caucasus. In Asia it is found in Siberia, the Ural and Altai and Baikal regions, and in Kamptschatka; whilst in America its range extends throughout Canada and the Northern United States. The American plant has been called *S. pennsylvanica*, Willd., but it differs in no respect from the Old World species.

The Ostrich Fern—the name by which this species is often called in books, being a mere translation of the scientific name *Struthiopteris*—was introduced to cultivation in this country in 1760, by Peter Collinson, who had it in his garden at Mill Hill; but it is much less frequently met with in our gardens than its merits deserve. It is very easily grown, as it will do well either in shady or exposed situations, preferring a deep, moist, sandy soil. It may be effectively employed on the borders of streams or waterfalls. This species is readily propagated by means of its creeping stolons, and is quite hardy. *Onoclea sensibilis*, to which reference has already been made in our notice of the genus, is also a very hardy plant, and one which is equally worthy of cultivation with the European species. It is indeed somewhat remarkable, considering how popular ferns have become, that more prominence has not been given to the hardy out-door species. Such plants as those now under consideration are easy to establish, and when once settled, require scarcely any further attention; and there seems no reason why they should not be met with in our gardens as frequently as the common Male Fern.

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## WOODSIA.



THE genus *Woodsia*, although not a large one, about fourteen species being enumerated, is of wide distribution. Besides the three natives of Europe, of which we have to speak at length, one species is confined to Natal, two are peculiar to Northern India, one is limited to the Caucasus, and the remainder are for the most part South American. They are in the main small plants, similar in habit to the European species, but the fronds of *W. guatemalensis* are sometimes as much as a foot-and-a-half in length. The genus was established by Robert Brown in 1813, and was named by him in compliment to Joseph Woods, a well-known British botanist.

WOODSIA HYPERBOREA, *Brown*.

This is one of the smallest rock species. It possesses a densely-tufted caudex, or stock, very short, thickly set with the brown, persistent, erect bases of the fallen fronds, and giving off many long filamentous black roots. The fronds are few and of small size, varying in length from one-and-a-half inches to as much as five inches in luxuriant specimens; the stipes is rather stout for the size of the frond, stiff, reddish, and shining, and sparsely provided with small, scattered, elongated or hair-like yellowish-brown paleæ. At a point rather more than half an inch from the base is a joint in the stipes, at which point the frond when withered breaks away, leaving the lower part of the stipes attached to the caudex; this remains for a long period, and the numerous stiff, abruptly-broken-off stumps give a characteristic appearance to the plant. The frond is narrow and oblong, sometimes almost linear, in outline, and somewhat suddenly narrows into the rather blunt point; the pinnæ are few in number, small, one-fourth to three-eighths of an inch in length, sessile, often distantly placed and never overlapping, generally somewhat bluntly ovate-triangular in outline, but deeply cut into a few short, obtuse, rounded lobes or segments, which are in the lowest pinnæ faintly crenate at the base. In colour the fronds are pale bright green, often with a rusty or yellowish tint. There are usually some scattered hairs on the back and margins.

The sori are copiously produced, and are at first quite distinct from one another, but they often become afterwards confluent, and then appear to cover the whole back of the frond. Under a lens the sporangia appear to be mixed up with, and partially covered by, long curved hairs, and it is not until the former are carefully removed that a close examination can show that the origin of the hairs is really the margin of the indusium. This membrane occupies here the unusual position of being quite beneath the sorus; it is small and completely concealed by the sporangia, but its margin is produced into numerous long, pointed, faintly-partitioned hair-like processes, which spread out all round and curve up round the margin of the sorus overlapping the sporangia. These capillary processes are so like the ordinary hairs on the surface of the frond that their different nature was for a long while unsuspected, and only made clear by the lucid exposition of Brown and the beautiful drawings of Francis Bauer.\* The sporangia themselves are shortly stalked, and are not supported on any common receptacle; they present no special peculiarity.

\* "Transactions of the Linnean Society" for 1816 (vol. xi.).









WILLOW & BIRCH LEAVES - FERNS - WILLOW & BIRCH LEAVES

PLATE 100



This little fern, as its specific name *hyperborea* expresses, is truly northern in its range. This is, however, very wide, extending round the boreal world in Europe, Asia, and America. In Europe it is especially found in the highest latitudes, and when it occurs further south it is only at lofty elevations. It is frequent throughout Norway, the northern part of Sweden, Lapland, Finland, and North Russia, growing in the crevices of exposed granitic and basaltic rocks. It does not occur in calcareous districts. In the mountain ranges of Europe the *Woodsia* is a scarce species, though locally abundant in a few spots. In the Alps it occurs in several places, as on Mont Cenis, Mont St. Gothard, Zermatt, the Upper Engadine, &c.; in the Tyrol it is found in abundance at the Seiser Alp and in the Oetzthal; and in the Pyrenees in two spots, one on the Maladetta. There are also isolated localities in Carinthia and Silesia, and the plant also grows in the mountains of Corsica and Sardinia.

In the British Isles this is one of our rarest species, and there are but three localities. One of these was known so long ago as about 1680—the moist rocks of Clogwyn y Garnedd, facing the east on one of the highest points of Snowdon, North Wales. There it was first discovered by Mr. Lhwyd (from whom there is a specimen in Buddle's herbarium in the British Museum), and it still grows there. Mr. Newman refers Lhwyd's plant to the next species; but so far as can be judged from the specimen just alluded to, which is imperfect, it is *W. hyperborea*. The other two localities are in Scotland—on Ben Lawers, Perthshire, and in Glen Isla, in the Clova Mountains of Forfarshire. The similarity of the fronds to the leaves of the common Red-Rattle (*Pedicularis sylvatica*) has often been noticed, and the resemblance is embodied in the original name given to the Snowdon plant by Lhwyd.

Beyond the boundaries of Europe, *W. hyperborea* grows in the Ural Mountains, in the Songarian district, the Amur and Manschuria, and extends as far as Mongolia and Northern China. These Asiatic forms have been named as distinct species by Russian botanists (*W. pilosella*, Rupr., *W. asplenoides*, Rupr., and *W. subcordata*, Turcz). There is also a southward extension of the range of the plant in the Himalaya Mountains. In America the species is confined to high northern latitudes, only occurring in Canada as far as the Saskatchewan, and not reaching southwards into the United States. It has been doubtfully recorded for Iceland, but does not occur in Greenland.

#### WOODSIA ILVENSIS, *Brown*.

Whether there are sufficient grounds to justify the position of this as a distinct species from *W. hyperborea* is a question upon which the best authorities are not in accord. It is certainly difficult at times to decide to which a given specimen may belong, and intermediates seem to occur, but usually the two are readily separable. Brown, who founded the genus, though he followed the general opinion in keeping the two species, expresses himself as more inclined to consider them varieties of one; Milde combines them, and calls *W. hyperborea* (Brown) by the name var. *arvonica*, whilst *W. ilvensis* (Brown) is called var. *rufidula*, these being old specific names restored. On the other hand, Sir J. E. Smith thought them quite distinct species, and they are retained as such in Hooker and Baker's "Synopsis Filicum." Mr. H. C. Watson reports a circumstance which, if correct, would settle the question—that a portion of a plant of true *W. hyperborea*, sent from the Botanic Garden at Edinburgh to Professor Arnott, ultimately turned out to be *W. ilvensis*.

The present species is, on the whole, a decidedly larger plant than *W. hyperborea* (some of the American specimens are very much so), the fronds frequently measuring eight inches



in length, or even more; the stipes and fronds are usually more densely provided with paleæ, and are indeed sometimes quite shaggy from their abundance. In outline, the fronds are broader in the middle and lower part (more lanceolate) than in the last species, and the pinnae are usually considerably longer and divided into oblong or oval longer segments. In other respects the two species are similar.

The localities of this fern are quite similar to those of *W. hyperborea*, but it is more frequently met with, and has a wider distribution. In Great Britain, for instance, we have seven or eight stations for it. Besides the three given under the last species—all of which produce this also—the plant occurs in several places near Moffat, Dumfriesshire, and on the border of that county and Peebles; it also extends into England, being found on the rocks at Falcon Clints, in Teesdale, Durham (a locality remarkable for its Alpine flora at a low elevation), and in Westmoreland. In Wales, it was recently discovered on Cader Idris, by Mr. James Backhouse.

In Northern Europe this fern is frequent through the Scandinavian peninsula, and extends into the Arctic regions, reaching Nova Zemlia and Iceland. It belts the polar regions, occurring in Greenland and Labrador, the northern parts of Canada, reaching to Unalashka, Alaska, and, crossing into Kamptschatka, extends through Siberia and Russia. In more temperate regions it has a wide distribution in the mountain districts of Europe, Asia, and America. It does not seem to occur, however, in the Swiss Alps, nor in the Pyrenees, but is found in Tyrol and Hungary; and there are stations for it in Bohemia, Silesia, Hesse, and other parts of Germany. Eastward it reaches the Crimea, Southern Russia and the Caucasus, and further into the central Asiatic regions of Siberia and Dahuria, and reaches Japan. On the American continent it is frequent in Canada and the United States as far south as Carolina, especially along the chain of the Rocky Mountains.

#### WOODSIA GLABELLA, *Brown.*

This elegant little species was first distinguished from its congeners in 1823, the specimens originally examined being collected by Dr. Richardson in North-Western Canada, near the Great Bear Lake, in Captain Franklin's expedition. It is well distinguished from the species already described by its smaller size, the completely smooth fronds, without hairs or paleæ, and the shape of the pinnae, as described below. The stipes is bare to the base, where, however, are many orange-coloured paleæ—very long, and cut into a few long filiform teeth at the margin. The length of the fronds varies from one and a-half to four inches, being usually about three inches; their outline is narrow, decidedly linear-oblong or slightly lanceolate, and tapering to the apex; the pinnae are small—scarcely over a quarter of an inch in length—sessile, and distantly placed, especially in the lower portion; their form varies, the lower ones are as broad as long, rounded in their circumference, and deeply and irregularly cut into a few wedge-shaped segments, dentate at the top; those in the remainder of the frond are ovate or oblong-ovate, more or less acute, and have their segments oblong or oval. The sori are abundantly produced, and are quite similar to those described in the other species, the hair-processes of the indusium, however, being not quite so long.

*W. glabella* is a very rare species in Europe, and its few localities are widely scattered. We have seen specimens from the Alten Valley, in Lapland, and from several localities in Southern Tyrol. In this latter region it is found chiefly on dolomitic rock, as on the Seiser



Alp, at Windisch-matrei, and at Weisenstein, near Sexten. Another locality in Carinthia completes the short list of European stations for this scarce little fern.

Out of Europe the plant is found to extend eastward through the Ural and Baikal districts of Siberia, and as far as Kamptschatka; whilst on the American continent there are several localities known in Canada, in the Rocky Mountains, and the plant is recorded from Labrador, and from Disco, Greenland.

The species of *Woodsia* are not very frequently met with in cultivation, although they are grown with little difficulty if properly treated. The drainage of the pots must be fully provided for, the soil being a mixture of fibrous peat and silver sand, with a small portion of loam. They succeed best in a northern aspect, and require plenty of water during the growing period.



WOODSIA ALPINA AND WOODSIA ILVENSIS.





## DICKSONIA.



THE genus *Dicksonia* is most fully represented in tropical America and Polynesia ; one species (*D. punctilobula*), however, extends as far north as the United States and Canada, several others being abundantly scattered through the warm southern parts of the temperate zone. There are from thirty to thirty-five species, varying greatly in size and in the cutting of the fronds, some—such as *D. antarctica*, a native of New Zealand and Australia, frequently seen in our greenhouses—being tree-like in habit, having stems from ten to forty feet in height, while others have creeping rootstocks. One of the tree species, *D. arborescens*, was introduced to English cultivation in 1786 from St. Helena, to which island it is peculiar ; like many other of the indigenous plants of that island, however, it is now dying out there. The genus is technically distinguished by having the sori situated at or just within the margin of the pinnule, at the apex of a vein ; in about half the species the involucre is distinctly two-valved, while in the remainder it is cup-shaped or but very indistinctly two-valved : the stalked sporangia split transversely, and have an incomplete vertical ring.

The fronds are, in some of the larger species, such as *D. antarctica*, as much as two or three yards in length and two feet or more across ; but their more usual dimensions are from one to two feet long and from six inches to a foot broad. In some species, such as *D. moluccana*, from Java, the stems are thickly furnished with strong hooked prickles ; in others they are densely clothed at the base with a thick coat of yellow-brown, often shining, hairs ; the stems of *D. Sellowiana*, from tropical America, are so densely clad with long fulvous hairs, changing to brown or blackish, that Mr. Spruce says they “precisely resemble the thighs of the howling monkey.”

The so-called “Tartarian” or “Scythian lamb,” about which strange stories were told by early travellers, is the long caudex of a plant of this genus (*D. Barometz*) : this is covered with long silky hairs, which look like wool when old ; and by judicious manipulation the natives of Southern China (where the fern grows) convert it into a rough resemblance to a lamb, the caudex being inverted, and supported on the bases of four of the lower fronds. The true history of the “lamb” was not known until 1725, when Dr. Breyne, of Dantzic, published a description of it as it really existed. In a curious folio volume, published in 1791, entitled “Museum Britannicum, or a display in thirty-two plates, in antiquities and natural curiosities, in that noble and magnificent cabinet the British Museum,” by John and Andrew von Rymsdyk, there is a striking figure of a specimen which is still to be seen in the public gallery of the Department of Botany in that institution. The authors, although speaking of it as a “zoophye,” state, accurately enough, that “it is nothing but the root of a plant much like fern ;” but they quote, as “very singular and amusing,” the following description of it from “Les Voyages de Jean Struys,” which, as it shows the notions which were formerly entertained concerning this “strange plant-animal,” we here quote. “This surprising fruit has the figure of a lamb, with the feet, head, and tail of this animal distinctly formed : whence it is called, in the language of the country, *Bonnarez* or *Boraner* : each of which Muscovite names signifies little lamb. His skin is covered with a down very white, and as fine as silk ; the Tartars and Muscovites









DAVALLIA CANARIENSIS S.M. (THE HARE'S FOOT FERN.)

UNDER SIDE OF FROND WITH SPOROPOHYTES (SPOROPOHYTES UNDER LEAFLET OF THIS FERN)  
 SPOROPOHYTES UNDER LEAFLET OF THIS FERN (SPOROPOHYTES UNDER LEAFLET OF THIS FERN)



esteem it very much, and the greater part keep it carefully in their houses, where this author has seen many. It grows on a stalk of about three feet in height; the place by which it holds is a sort of navel, on which it turns and bows itself towards the herbs which serve it for nourishment, dying and withering away as soon as these herbs fail. Wolves love it and greedily devour it, because of its resemblance to a lamb. All this description contains nothing hitherto incredible; but what the author adds, that this plant has really bones, blood,



SCYTHIAN LAMB.

The three figures on the left of the cut are adapted from old representations of the "Lamb"; while the actual rhizome with fronds springing from it is shown on the right.

and flesh, whence it is called in the country by a Greek name Zophyte, that is, a plant-animal."

Those who are interested in learning further particulars of the history of the "Scythian Lamb," and of the fictions and traditions which were associated with it, will find abundant material in Breyn's "*Dissertatiuncula de Agno Vegetabili Scythico, Borametz vulgo dicto*," published in the "*Philosophical Transactions*" (vol. xxxiii., pp. 353—360). The treatise is accompanied by a striking representation of the object described, of which the upper figure



in the accompanying cut is a much reduced copy. The plant was introduced into cultivation in England about fifty years ago by the late Mr. John Reeves; the living specimens transmitted by him bore fruit in the Birmingham Botanic Garden, and were shortly afterwards described by Mr. John Smith under the name of *Cibotium Barometz*—the genus *Cibotium* being now more usually united with *Dicksonia*.

It is not surprising that so remarkable a plant should have received the honours of poetical treatment. Darwin, in the "Botanic Garden," thus summarises its traditional history:—

"Cradled in snow and fann'd by arctic air,  
Shines, gentle Barometz! thy golden hair;  
Rooted in earth each cloven hoof descends,  
And round and round her flexile neck she bends;  
Crops the gray coral moss and hoary thyme,  
Or laps with rosy tongue the melting rime;  
Eyes with mute tenderness her distant dam,  
Or seems to bleat, a vegetable lamb."

The Sieur du Bartas, at an earlier period, likewise honoured the plant with a description in which its paradoxical nature is forcibly brought out. Having depicted the amazement of our first parents when such a prodigy of nature first presented itself to their astonished gaze, he piously continues:—

"O merveilleux effect de la dextre divine!  
La plante a chair et sang, l'animal a racine;  
La plante comme en rond, de soy mesmes se meust;  
L'animal a des pieds, et si marcher ne peut;  
La plante est sans rameaux, sans fruit, et sans feuillage;  
La plante a belles dents, payst son ventre affamé  
Du fourrage voisin; l'animal est sémé."



SCYTHIAN LAMB (copied from the title-page of  
Parkinson's "Paradisus," 1629).

Judging from specimens brought to this country, it is difficult to imagine that the resemblance can ever have been considered a striking one.

The silky hairs covering the base of the stem of this, or of a closely allied species, have been used as a styptic in Germany, being imported from Sumatra. The similar hairs of other species of *Dicksonia*, natives of the Sandwich Islands, are exported, to the extent of many thousands of pounds annually, under the name of Pulu, and are employed in the stuffing of mattresses, cushions, &c.; and the hairs of *D. Culcita* are used in like manner in Madeira. Not more than two or three ounces of hair are

yielded by each plant, and it is reckoned that about four years must elapse before another gathering can be obtained.



DICKSONIA CULCITA, *L'Heritier.*

This is a large and handsome fern, though, compared with some other species of the genus, it is quite of humble stature. The caudex, indeed, is small, only three or four inches high, rooting, with the end deflexed, and thus gives none of the tree-like character so characteristic of some of the congeners of the plant. It is, however, remarkable in being quite without the ordinary paleæ or scales, but instead is very thickly and densely cushioned, especially at the apex, with a mass of long, golden-orange, shining hairs, which are over an inch long, and under the microscope are seen to be jointed. The fronds are of large size, attaining a length of four to six feet, and arching outwards, they are supported on a long stipes, which is perfectly smooth and devoid of paleæ or hairs, shining and pale brown; in form the stipes is bluntly angular, and so much channelled along the upper surface as to be thin and crescent-shaped in section, when a single curved bundle of vessels is seen. The form of the frond is rather broadly triangular, but drawn out at the apex; it is much divided, quadri-pinnate, coriaceous, dark green, and perfectly smooth. The primary pinnæ are wide-spreading and ovate-acuminate in outline, the secondary ones rather ovate-oblong, and frequently much attenuated at the point; whilst the ultimate divisions are oblong, rather obtuse, oblique, and deeply pinnatisect; the segments (at least, the lower ones and those without sori) bluntly dentate, with a few thick teeth. The venation is simply forked.

It is, however, the sori that are particularly noticeable, as they are usually produced in great abundance. They are large, nearly one-quarter of an inch in diameter, sub-globose, and each one occupies nearly the whole segment, which then, instead of being toothed, is dilated, and with a rounded deflexed margin. Their structure is peculiar, and differs from that of all the other European ferns. The very large, thick, brown indusium is attached by a semi-lunar base below the sorus, and at first is united by its upper edge to the deflexed margin of the segment, so that the whole forms a thick marginal case, rounded, but flattened on the top. Afterwards this separates, and the indusium exhibits an entire semi-circular free margin, or lip, whilst an upper lip is formed by the margin of the segment; at length the lower lip becomes separated also at the sides and deflexed. The sporangia are small, very numerous, on long stalks, bright yellow, and mixed with many brown barren filaments (paraphyses); they open by a transverse chink, and possess a complete oblique annulus.

A special interest attaches to this fern from its being the only member of the great tropical group of the *Cyatheaceæ* which reaches Europe. Its footing, indeed, on this continent is but slight, consisting of, as far as known, but a single locality in Southern Spain, discovered in 1869. This is near Algeciras, the little town which faces Gibraltar across the bay.

The head-quarters of *D. Culcita* are, apparently, in the Azores Islands, where it is very abundant in the woods, especially at an elevation of from 2,000 to 3,000 feet. There are specimens in the British Museum from S. Miguel, collected by Masson so far back as 1778. In Madeira the plant is not now common, being chiefly found near S. Vincent and on the north-west side of the island. When we add Teneriffe to its localities, we have traced the whole range of this species, which will be thus seen to be a marked member of that peculiar Atlantic flora of which a few species reach our western shores. The fern does not occur in the Canary Isles; and the species from the mountains of Central America and the West Indies, often referred to *D. Culcita*, is an allied species—*D. conifolia*, Hook.

Another name for this fern is *Balantium Culcita*, Kaulf.



## TRICHOMANES.



We possess but a single species of this genus ; but it is one of the most interesting, as well as one of the most beautiful of our British ferns, forming the solitary European representative of a large group of from eighty to a hundred species which are abundant in the moist, shady, tropical woods of the Eastern and Western hemispheres. Like the Filmy Ferns, to which they are closely allied, the Bristle Ferns vary a good deal in habit, the fronds being simple, pinnate, or decomposed, but agreeing in their membranous pellucid texture. One of the most remarkable of the entire-fronded species is *T. reniforme*, a plant confined to New Zealand ; in this the fronds are rigid and erect, two to four inches broad, and somewhat kidney-shaped, the numerous involucres being crowded along their edges. Another singular species belonging to this section has been discovered by Hildebrandt in the Comoro Islands, and named *T. Hildebrandtii* ; in this the circular fronds, about the size of a florin, are closely pressed to the trunks of the trees on which it grows, and resemble a liver-moss on a large scale. In a few species, natives of tropical and South America, the sterile and fertile fronds are very different in appearance, the latter consisting of a narrow distichous spike ; but they are usually uniform, varying in length from two or three lines to eighteen inches or more. *T. Barklianum*, a Mauritian species, is the smallest known fern, with the exception of the Malayan *Hymenophyllum parvifolium*, which is about the same size ; it is calculated that it would take upwards of fifty fronds of these species to cover a square inch. Another Mauritian species, *T. giganteum*, is among the largest of the genus, having quadri-pinnatifid fronds from a foot to a foot-and-a-half or more in length, and about half as broad. *T. pinnatum*, a tropical American species, is a dimorphic plant, the fronds in the normal state being pinnate, and often rooting and proliferous at the apex ; in other specimens, however, they are long and narrow, about an inch broad throughout, and fringed with the fructification. *T. membranaceum*, which is also tropical American, has scarcely stalked, roundish, broad, irregular membranous fronds, which are fringed at the margin with a double row of peltate scales ; in habit it resembles the Peacock's-tail Seaweed (*Padina pavonia*). In several species the fronds are so finely divided as to present a feather-like appearance ; while in *T. lucens* and its allies the rachis is densely covered with brown hairs.

## TRICHOMANES RADICANS, Sw.

This is known as the Killarney Fern. It has a long, black, tough, branched, wiry rhizome, having a tomentose or woolly appearance, which is due to the presence of very small-jointed brown bristly paleæ, and in large and old specimens extending several yards in length. From this arise, at very long intervals, the pendulous fronds ; these are of a pellucid membranous, but firm, texture, which, as Mr. Newman observes, "particularly resembles some of the marine Algæ ;" they are supported on a long, round, smooth stipes, with a narrow membranous wing running down each side. The leafy portion of the frond is usually about four to six inches in length, but may be smaller, or even reach a foot long ; in outline it is usually ovate-oblong and acute, and it is elegantly bi- or tri-pinnatisect. The pinnæ are alternate, the lower being









1. *TRICHOMANES RADICANS* (THE KILLARNEY FERN.) 2. *HYMENOPHYLLUM TUNBRIDGENSE* (TUNBRIDGE FERN)  
3. *HYMENOPHYLLUM WILSONI*. (WILSON'S FERN)

(NATURAL SIZE.)

1<sup>a</sup> PINNULE WITH FRUIT. 2<sup>a</sup> PINNULE WITH FRUIT. 3<sup>a</sup> PINNULE WITH FRUIT.



from one to three inches long, somewhat ovoid in shape, the upper ones becoming gradually smaller; they are deeply cut into oval or oblong pinnules, which are themselves cut into linear bluntish teeth. A dark firm vein runs through each of these divisions, and is the more conspicuous on account of the pale transparent green of the foliaceous portion of the frond; so striking indeed is it, that the frond has been described as consisting of a series of three or four times branched rigid veins, bordered throughout by a thin pellucid wing. These veins end at the apex of the segments, when the fronds are barren; but in fruit-bearing specimens they are produced beyond it into a bristle-like point, to the appearance of which the name "Bristle-fern" is due. This forms a receptacle, upon the base of which is situated the small roundish cluster of sporangia; this is surrounded by a cup-shaped involucre, formed by the indusium and frond-segment, which are very similar in texture; the cup is open at the top, which is very slightly two-lobed. The bristle-like receptacle projects a variable distance beyond the edges of the cup, as shown in the figure at the end of this article. The sporangia are sessile, pear-shaped, and provided with a complete transverse ring. The spores are pale, somewhat greenish in the centre, and very minutely granulated. The fronds in the Irish plant are three years in arriving at maturity; when growing in a moist situation, they will remain beautifully green for many years, provided that the fruit be not matured; in the latter case, however, the fronds change colour and begin to wither away as soon as the spores have been shed. Mr. Andrews, who studied the plant in its native Irish localities, is of opinion that the fructification is only matured in warm dry seasons, and that even then it is comparatively rare, the sporangia being duly formed, but failing to attain sufficient ripeness and elasticity to discharge the spores. In Madeira the fronds are stated to be fertile in their second year, and in Mexico they bear fruit the first year of their existence.

It was at one time thought that we possessed in Ireland a second species of *Trichomanes*, for which the name *T. Andrewsii* was proposed by Mr. Newman, in commemoration of its discoverer, Mr. Andrews; this, in its most characteristic state, differs from *T. radicans* in having narrower and proportionately longer fronds, a scarcely tomentose rhizome, and receptacles produced very much beyond the involucre. But however different in extreme examples, it has been found that these characters are not of permanent value, intermediate specimens between the two forms being readily found. *T. Andrewsii* was originally found at Glouin Caragh, Co. Kerry, and subsequently at Killarney.

The Killarney Fern has been reported of late years from various localities in England. Whether it is to be regarded as an introduced plant is perhaps open to question, but there can be no doubt that it grew in Yorkshire less than a century ago, and that it had then been known to grow there more than fifty years. In the third edition of Ray's "Synopsis" (1724), this fern is mentioned as having been found by Dr. Richardson "at Belbank, scarce half a mile from Bingley, at the head of a remarkable spring, and nowhere else that he knows of." There is no ground for the supposition that some other plant was mistaken for the *Trichomanes*, inasmuch as there is a specimen in one of the volumes of the Sloane Herbarium (vol. ccii, p. 66), in the British Museum, with a ticket appended in Dr. Richardson's handwriting:—"This beautyfull capillary I lately found in the moist and shady rocks nigh Bingley." In the large herbarium of British plants contained in the collection of the British Museum there is also another specimen from the same locality collected by Hudson; and the following detailed account of the occurrence of the plant at Bingley is given in Bolton's "Filices":—"First discovered by Dr. Richardson in a little dark cavern under a dripping rock, a little below the



spring of Elm Cragg Well, in Bell Bank, scarce half a mile from Bingley. In this place I saw it in plenty in the year 1758: afterwards, some alterations being made about the well, for the convenience of the proprietor, the cavern was destroyed, the plant perished, and was lost to Great Britain till the year 1782, at which time being engaged in this work, and passionately desirous to see the plant again in its growing state, after several researches in Bell Bank, I found a root under a dripping rock, to the left side of the current, and about fifteen yards above the cistern. From this root I have sent specimens to one or two of my friends, and have in my possession the best of them, from which this figure and description were taken." In the same year (1782) the *Trichomanes* was found at Bell Bank by Mr. Teesdale;\* since which time it does not appear to have been observed there, although there is a specimen in the British Museum which is said to have been collected in Yorkshire in 1871. In 1867, the *Trichomanes* was found by Mr. Everard in Thurm, on a rock overhanging the water about a quarter of a mile below the fall at St. Knighton's Kieve, on the northern coast of Cornwall, about two miles from Tintagel Castle, and the same distance from Boscastle; only one patch was seen, and the fronds were of small size, not much over two inches in height. The possibility of its introduction to this locality is suggested; and the same suspicion attaches to the Rydal district of Westmoreland, where it was found on wet rocks in one of the fells by Mr. Walter Crouch about 1863. About this period it was recorded from the Snowdon district of Caernarvonshire, where it was found by two or three botanists, who prudently abstained from describing the exact spot. It has been stated that the fern was introduced into this district from Ireland by a Snowdon guide; but there seems no doubt whatever that it had been known to occur there about thirty years before this date, in two distinct localities, and that the original discoverers of it, who carefully concealed their knowledge, were satisfied as to its genuine nativity. The Killarney Fern was also found in the Isle of Arran by a local fern-collector; and it has been recorded, but apparently in error, from Derbyshire and Caermarthenshire.

Although generally known as the Killarney Fern, the *Trichomanes* extends through a considerable portion of the south and south-west of Ireland, occurring on wet shady rocks in several localities in Kerry and Cork, as well as in the counties of Waterford, Limerick, Wicklow, and Tipperary: it was discovered at the Turk Waterfall, Killarney, in October, 1805, by Mr. J. T. Mackay; but in this locality it is almost, if not quite, extinct. The natives of the Killarney district are in the habit of offering to tourists specimens of *Hymenophyllum Wilsoni* as the "Killarney Fern;" and the superficial resemblance is sufficient to mislead those who are not acquainted with the true plant. It ranges in elevation from the sea-level to about 1,000 feet on Carrigeena, on the northern border of county Cork. Its distribution on the continent of Europe is extremely limited; indeed, it is only known to occur in the shady woods of Gallecia, in Spain: Willkomm and Lange indicate it as found also in Portugal, but we find no other reference to it as occurring there. Its strongly "Atlantic" type is shown in this distribution, and by its occurrence in the Azores, Madeira, and Teneriffe. But if we take the somewhat broad view of the species adopted in the "Synopsis Filicum," we find it has a further very wide distribution: in Africa it is recorded from Angola and Fernando Po, as well as from Johanna Island; in Asia it occurs in the Himalayas, Japan, and Polynesia; and in tropical America it extends from Alabama, Mexico, and the West Indian Islands southward to Rio Janeiro.

The plant is more correctly called *T. speciosum*, Willd. It has also been named *T. alatum*,

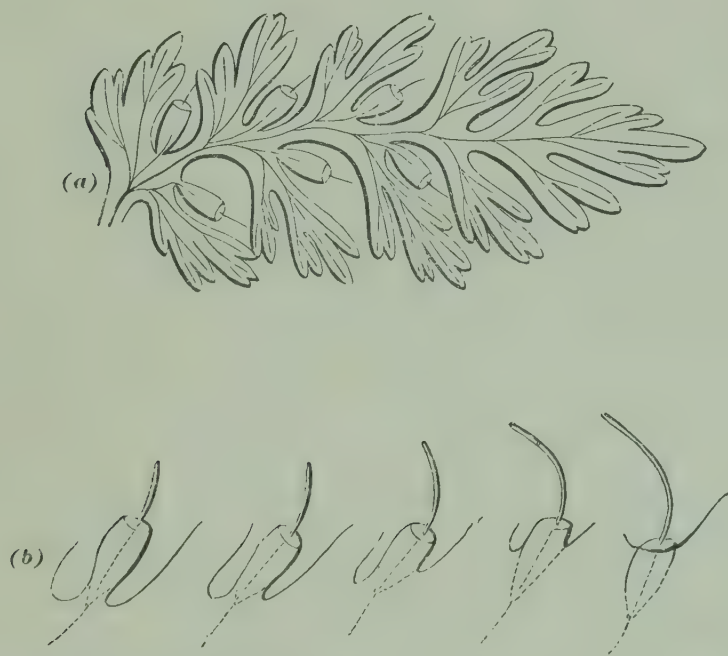
\* See "Transactions of the Linnean Society," v. 75.



Hook; and *T. brevisetum*, Brown. It was regarded as merely a variety of the Tunbridge Fern by the older English botanists, who knew only the small Yorkshire specimens.

This species has been very popular in cultivation since the introduction of the Wardian case; a moist atmosphere, with shade and warmth, seem to satisfy all its requirements; and it will grow and flourish in a common earthen pot, if this is covered with a bell-glass and allowed to stand in water. It was formerly, however, extremely difficult to grow successfully; and Mr. Ward tells us that Fischer, the superintendent of the Petersburg Botanic Gardens, "when he saw the plant growing in one of my cases, took off his hat, made a low bow to it, and said, 'You have been my master all the days of my life.'" It will grow well in rough peat and sphagnum moss, or on a lump of sandstone, and is apparently capable of enduring a very low temperature. Mr. Backhouse says that, with him, "though frozen into a mass of ice, which encrusted and buried it many inches deep for many weeks, it thawed out as fresh and fine as any one could desire." The late Dr. Moore, of the Glasnevin Botanic Gardens, Dublin, was remarkably successful in growing the Killarney Fern, as well as the British species of *Hymenophyllum*; the walls of a small greenhouse were literally carpeted with these plants, and their appearance was extremely beautiful.

The name *Trichomanes* was not originally applied to the ferns with which it is now associated, but to an *Asplenium*, which is still known as *Asplenium Trichomanes*, so that the name and its meaning may be more appropriately considered when we come to speak of the last-named plant.



(a) PINNULE OF *TRICHOMANES RADICANS*, MAGNIFIED; (b) INVOLUCRE SHOWING  
VARYING LENGTH OF RECEPTACLE.



## HYMENOPHYLLUM.



THIS is a large genus of ferns, including about eighty species of delicate plants, two only of which are found in Europe, the remainder being distributed through the temperate and tropical portions of the globe. They grow usually in moist places, upon rocks, or on the trunks of trees, often forming dense masses netted together by the branched thread-like rhizomes. They vary a good deal in size: some, such as *H. parvifolium*, a native of Moulmein, being minute plants, with stems only a line long, and tiny fronds scarcely more than twice that length; others, as *H. sericeum*, from tropical America, have long narrow fronds, which are sometimes as much as two feet long, although a foot is their more general size. The fronds are occasionally simple, as in the case of the very distinct *H. cruentum*, a Chilian plant with reddish fronds three or four inches long and an inch or more broad in their lower portion; but they are more usually either simply or twice or thrice pinnatifid. About half the species are smooth and free from hairs, the remainder being more or less ciliated, or hairy upon the surface. Some beautiful species are in cultivation, such as *H. sericeum* already mentioned; *H. caudiculatum*, a Brazilian species with broad fronds, the ends of which are lengthened out into tail-like points; *H. multifidum*, from New Zealand and the islands of the Pacific, having finely-divided fronds about six inches long and nearly as broad; and many more, chiefly from New Zealand and the West Indies. The Filmy Ferns are somewhat difficult to cultivate; a very damp atmosphere is absolutely essential to them, and the amateur will find the Wardian case the most suitable treatment. Some succeed best upon logs of wood or tree-ferns, while others will grow well in a mixture of bog-moss and fibrous peat, with lumps of sandstone, the drainage being carefully attended to, as the water must not be allowed to stagnate.

A very natural group (the *Hymenophylleæ*) is formed by the two genera *Hymenophyllum* and *Trichomanes*, the species resembling each other greatly in form and habit, as well as in the pellucid membranous texture of the fronds. They are technically distinguished from all other ferns by the sori being borne at the margin instead of at the back of the fronds, the spore-cases being contained in deep urn-shaped cavities, and clustered round hair-like receptacles, which are the ends of the veins of the fronds. In *Hymenophyllum* the indusium is more or less deeply two-lipped or two-valved, while in *Trichomanes* it is entire; and this constitutes one principal technical difference between the two genera, the other being that the receptacles in *Hymenophyllum* are short, and included within the indusium; while in *Trichomanes* they are continued beyond it, being often elongated and filiform, or bristle-like, in appearance.

## HYMENOPHYLLUM TUNBRIDGENSE, Linn.

This and the next species are the smallest of our British ferns, and from their inconspicuous olive-green hue and insignificant size, are frequently overlooked. They grow in dense masses, the slender black wiry filiform creeping rhizomes forming a matted network, from which arise the short membranous fronds. In the present species these are about one and a half to three inches long, and have a delicate cylindrical stipes; they are ovate-lanceolate in outline, acuminate, deeply pinnatisect, a narrow wing of membrane connecting the pinnæ into one





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Vincent Brooks Day & Son Lith.

CYSTOPTERIS. (THE BLADDER FERN.)

1. CYSTOPTERIS FRAGILIS. 2. CYSTOPTERIS SUDETICA. 3. CYSTOPTERIS MONTANA. 4. CYSTOPTERIS ALPINA.

(NATURAL SIZE).



frond; each segment is short and pinnatifid, and spreads vertically; the alternate segments are narrow, obtuse, and distantly but conspicuously serrate. No stomata occur on the fronds of this or the other species. The fructification is usually produced in the upper half of the frond, the sori, which have two nearly round short compressed valves or segments conspicuously serrate on their upper margin (indusium), being borne usually at the apex of the first vein on the upper side at the base of each pinna. The fronds are all annual, and more elegant than those of *H. unilaterale*.

The Tunbridge Fern likes shade, warmth, and shelter; it may be grown readily under a bell glass, especially if two small apertures be provided towards the top. It occurs naturally on moist rocks or old tree-trunks amongst mosses, which it much resembles; when growing on the perpendicular surfaces of shaded rocks, the fronds are often nearly pendulous, which is also the case with the next species.

*H. tunbridgense*, as understood by English authors, is a fern of limited range, occurring in Britain, France, Belgium, the Pyrenees, Saxony, the Tyrol, Italy, and Corsica; but the authors of the "Synopsis Filicum" include under the same name several plants which have been regarded as distinct by various authors, and the range is thus extended to South Africa, Mauritius, Madeira, the Azores, the Auckland Islands, New South Wales, Jamaica, Venezuela, Chili, and New Zealand, and this without including *H. Wilsoni*, which is regarded in the "Synopsis" as a variety of *H. tunbridgense*. In Britain it occurs, or has occurred, in the counties of Cornwall, Devon, Somerset, Sussex, Kent, Glamorgan, Merioneth, Westmoreland, Cumberland, Northumberland, Dumfries, Renfrew, Peebles, Stirling, Argyle, and Dumbarton, finding its north limit in Mull and the islands of the Clyde, and ascending to twelve hundred feet. In Ireland it is abundant in some of the western districts, especially in Kerry and Cork, but rare in the east centre and north of the island. From the greater part of central Europe, and all the north and east of the Continent and Asia, it is quite absent.



HYMENOPHYLLUM  
TUNBRIDGENSE.

The name *tunbridgense* commemorates the original discovery of the species near Tunbridge Wells, in Kent, some years before 1682, in which latter year it was found by Ray in Westmoreland: it is not now to be found in the neighbourhood of Tunbridge.

#### HYMENOPHYLLUM WILSONI, Hook.

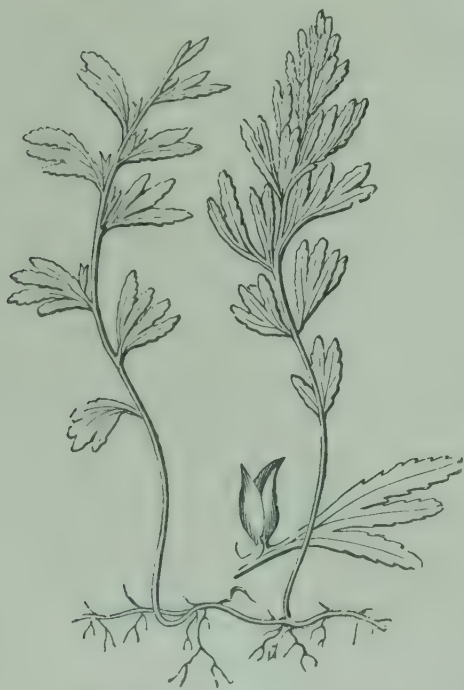
This has a general resemblance in appearance and habit to the last species, with which it was for a long time confounded: the two are certainly nearly allied, but there are differences between them which a practised eye can readily detect, and which seem sufficiently constant, at any rate so far as British plants are concerned. *H. Wilsoni* is a larger and less elegant plant than *H. tunbridgense*, and is also more rigid and more coarsely reticulated. The fronds are not annual, but grow on year after year for several seasons, reaching, it is stated, as much as ten inches in length, though this must be of rare occurrence, but about six inches is a not unfrequent size. They differ in colour from those of *H. tunbridgense*, being of a darker green; Mr. Wilson describes the hue of the last-named species as "glossy green." The pinnæ have a strongly recurved habit. The sporangia, which are more or less stalked, are usually solitary on each pinna, but



occupy the same position as in the last species; next the rachis they are more conspicuous than those of *H. tunbridgense*; the valves or segments are ovate, and their margins are quite entire. The habit of *H. Wilsoni* is more erect; it affects somewhat different situations, and often occurs on bleak and exposed rocks.

In geographical range it is a more northern plant than *H. tunbridgense*, but the two species are sometimes found growing intermixed. In England it is recorded for Cornwall and Devon, Stafford, Salop, and most of the Welsh counties, Lancashire, Yorkshire, and the northern counties; it is pretty generally distributed through Scotland, finding its north limit in the Orkney and Shetland Isles. In Ireland it is much more frequent than the last, occurring in hilly districts in all parts of the country. Its Continental distribution is much more restricted than that of *H. tunbridgense*, the Faroe Islands and Norway being the only extra-British localities in Europe for the plant. Beyond the continent of Europe, however, it is recorded by different writers under different names from South Africa, the island of Bourbon, Madeira, and the Azores, the Fiji group, New Zealand and Australia, Chili, Guatemala, the Andes of Peru, and Brazil. Like the last it is absent from Asia.

The plant is more generally known under the name of *H. unilaterale*, Bory. Its name, *Wilsoni*, was given it by the late Sir William J. Hooker, in compliment to the late William Wilson, of Warrington, an assiduous British botanist, who added several species to the British flora, and whose "Bryologia Britannica" will long remain the standard work upon British mosses. He died in 1871, and his unequalled collection of mosses now forms part of the



HYMENOPHYLLUM WILSONI.

treasures of the Botanical Department of the British Museum. In the Supplement to "English Botany" (Tab. 2686), the plant is figured and described by Mr. Wilson, who says: "So very different in aspect is this truly distinct species from the far more elegant *H. tunbridgense*, that no botanist who has had the good fortune to see them luxuriantly growing in company in the rocky woods which border the wildly-sequestered Upper Lake of Killarney, would hesitate to pronounce them two species. It was there that, in the summer of 1829, I first became acquainted with the true *H. tunbridgense*, and had at once the gratification of clearing up any doubts concerning the spurious kind, with which, as the common *Hymenophyllum* of North Wales, Cumberland, and Perthshire, I had long been imperfectly familiar, and also of unexpectedly adding another fern to the British flora. Hudson, who probably had seen and gathered both kinds, does not notice this species as a variety; but various botanists of modern times have suspected, though

they did not ascertain nor promulgate, the existence of two British species. . . . So constantly has this species been confounded with *H. tunbridgense*, that it is perhaps impossible to fix any certain reference to the works of Ray, or of any later author: it appears also to have been wholly unobserved on the Continent."



## DAVALLIA.



THIS is a large and handsome genus, having its head-quarters in the tropics of the Old World, and containing about a hundred species. As might be expected among so many, we find a great diversity in form and size—some of the species, indeed, differing so extensively from each other in habit, that were it not for the technical character, it would be impossible to trace the connection between them. A large number resemble the Hare's-foot Fern (*D. canariensis*), which is the solitary European representative of the genus, in general appearance. One small group contains species remarkable on account of their climbing habits, the fronds being several feet long, and the rachis in two West Indian species (*D. aculeata* and *D. uncinella*) being clothed with scattered prickles, and somewhat bramble-like in habit. The former of these attracted the attention of Plumier, who, writing in 1703, speaks of it as having a stem no larger than a writing-pen, but extending in every direction by means of long branches, which are as hard as wood and quite black and woolly. The whole plant resembles a bramble rather than a fern, in consequence of its spiny character. It occupies considerable space, climbing over the forest-trees near which it grows. In Hispaniola, Plumier speaks of having seen a whole field entirely covered with it, "in a place which the buccaneers call 'spiny bottom.' The same buccaneers call the plant the French Fern."

Another section, which is often regarded as a separate genus under the name *Humata*, and is very distinct in habit, is dimorphic, that is to say, the fronds are of two kinds, barren and fertile, and very different in appearance, the barren ones being sometimes entire; *D. parallela* at first sight almost exactly resembles the common Polypody (*Polypodium vulgare*); these are natives for the most part of the Malay Peninsula. *D. elegans* has long pinnate fronds, which are sometimes two feet in length, the sori being borne upon the edges of the pinnæ; *D. parvula*, on the other hand, is, as its name implies, of very small size, the fronds being less than an inch in length—produced at short intervals along the slender rhizome; in cultivation it will do well upon a block of wood, or upon the stem of a tree fern. Some species have fronds so finely divided that when mounted on paper they resemble most delicate lace; of these, a Fijian species, *D. fœniculacea*, having, as its name implies, fennel-like leaves, is perhaps the most striking.

The species of *Davallia* are not difficult to cultivate; they grow well in a compost of fitrous peat and sand, to which about one-fifth of fresh turfy loam may be added; they require to be thoroughly well-drained, although they like plenty of water when growing. Besides *D. canariensis*, another species, *D. pyxidata*, which much resembles it, has long been in cultivation in England, having been introduced from Australia by George Caley in 1808. Many Davallias are now grown, the genus having lately been very popular; one of the handsomest is *D. Moorcana*, a native of Borneo, which has gracefully arching and much divided pale green fronds about four feet in length, and nearly as broad at the base; a specimen, recently described, produced at the same time about 150 fully developed fronds, having a spread of 8½ feet. Another recent introduction, *D. Tyermani*, is a native of West Tropical Africa, and is readily distinguished by its silvery rhizome and dark glossy fronds. One species (*D. Novæ-Zelandiæ*)



is, as its name denotes, a native of New Zealand, and is interesting as having secured a temporary footing among British plants. It was found, in 1874, growing on the lower stonework of a bridge over the river Swale, near Thirsk, Yorkshire, having probably been washed from some garden by a flood. (See "Journal of Botany, 1875," p. 78.)

### DAVALLIA CANARIENSIS, *Smith.*

This pretty species is now familiar as a cultivated plant, under the name of the Hare's-foot Fern; it has long been an inhabitant of our greenhouses, having been introduced to the Royal Gardens at Hampton Court before 1699. It is readily known by its remarkable rhizome or caudex, which is quite above ground, creeping for a considerable distance, and climbing on or over rocks, walls, and trees, and when grown in pots speedily extending over their edges. This creeping aerial caudex is not of great diameter, not exceeding indeed half an inch, and produces many short branches; it is cylindrical, and sends off roots from its under side; and owes its peculiar appearance to the very dense covering of scales or paleæ with which it is completely enveloped. These scales are of considerable length and closely overlap one another; they are lanceolate-linear, broad at the base but tapering to a long point, and delicate greyish orange in colour, paler at the edges; at the extremities of the rhizome they form a blunt rounded cushion, from which the plant gets its name. The fronds are given off singly at considerable intervals on the elongated caudex, the growing point of which is always much in advance of the youngest frond; they vary from 6 to 18 inches in height, of which the stipes occupies fully one-third. This latter is erect, stiff, rounded beneath, but deeply channelled along its upper surface, and articulated with the rhizome; the base is surrounded with the paleæ of the caudex, but no scales or hairs of any kind occur on itself. The general outline of the frond is triangular or deltoid, not much longer than broad, with the wide-spreading pinnæ gradually diminishing in length upwards, few in number and placed alternately. It is tri- or quadri-pinnatisect in division; the pinnules are deltoid-lanceolate, and the ultimate divisions are lanceolate or oval, and deeply cut into narrow segments; the texture is coriaceous, and the colour bright green. The sori are terminal, each being borne at the summit of a vein which is thickened below its origin, and divides into two branches which run along the margins of the sorus, and are carried out beyond it into the two teeth of the fertile segments which project one on either side of the sorus; the indusium is attached at the base and sides so as to form half a cup, the semi-circular upper margin being free. The spores are yellow, oblong, and warty.

This Fern, like *Dicksonia Culcita*, is one of that type of plants to which the name Atlantic is applied, and has very much the same area as that species. It is in Europe confined to Portugal and south-western Spain, occurring in the former country frequently about Lisbon, the Serra de Cintra, &c., and in the latter in Galicia and Andalusia; in the latter province being particularly abundant about S. Roque, Algeciras, and the southernmost part of Spain—Tarifa. It grows especially over old stems of cork-oaks and olives, and shows a special liking for the neighbourhood of the sea. Beyond European bounds this species of *Davallia* has but a few localities. It is found in a few places on the opposite side of the Straits of Gibraltar, in Morocco near Tangiers; and it is a well-known fern in Madeira, the Cape Verde Islands, and Teneriffe. It does not grow in the Azorean group.

Linnaeus called this fern by two names; it is his *Potypodium lusitanicum*, and also *Trichomanes canariense*.



## CYSTOPTERIS.



WITH only one exception, the members of this small but elegant genus are reckoned among the ferns of Europe, and will therefore be considered in detail. The geographical distribution of the genus is thus exceptional among ferns, its head-quarters being found in the temperate zones of both hemispheres. *C. fragilis* is one of the most widely-distributed plants of the order; the others are more limited in their range. The extra-European species alluded to above is *Cystopteris bulbifera*, a very distinct plant, native of North America, extending from Canada southward to Virginia and North Carolina. It is the largest of the genus, the fronds being sometimes as much as a foot in length, and much narrowed at the apex; but its most characteristic feature, to which it owes its name, is to be found in the large fleshy bulblets which are formed beneath the frond in the axils of the upper pinnæ. These fall to the ground, and form new plants, which are about two years in coming to maturity; and the propagation of the species takes place to a great extent in this manner.

All the species of *Cystopteris* are well worthy of cultivation. They succeed best in rather stiff soil, care being taken that water is allowed to rest upon the crowns during the period of rest. They grow well also in cocoa-nut refuse mixed with a little loam, the pot—if grown as pot-plants—being about half filled with loose stones, so as to secure thorough drainage. As a rule, they do best in shady situations.

The name *Cystopteris* is formed of two Greek words, and signifies Bladder Fern, by which title the plants of the genus are often referred to in books; the allusion is to the hood-shaped indusium, which will be fully described hereafter.

## CYSTOPTERIS FRAGILIS, Bernh.

This is a pretty fern, of no great size, but rather remarkable for the great variability in the form of its pinnæ. It possesses a small, short, prostrate caudex, bright-brown in colour, with numerous long roots, and set at the growing end with many thin ovate, acute orange scales toothed at the edges. The fronds are numerous, and are given off in close proximity, so as to appear to grow in tufts. The stipites are slender and remarkably brittle, to which peculiarity the plant owes its specific name, *fragilis*; they are brown, and nearly bare of paleæ, except at the very base, and are nearly as long as the leafy part of the frond; the whole is usually under one foot in length, and generally only about six inches. The light-green delicate fronds are oblong-lanceolate or elongated, the pinnæ being largest about the middle of the frond, and decreasing in length towards both ends. They are usually bipinnate, with the pinnæ ovate in outline, and consisting of oblong-ovate pinnules, which are again cut into oblong obtuse segments or teeth. The sori are dorsal, small and circular, arranged in a row along either side on the lateral veins of the pinnule, often, however, becoming confluent, and covering much of the frond; they possess a peculiar indusium, which, though it covers the whole sorus at first, afterwards becomes an ovate bract-like, somewhat hooded membrane attached beneath one side of it, and is at length torn and reflexed, and may even wholly



disappear. The sporangia are at first pale, but become brownish-black and shining: the spores are round or oblong, and covered with small prickly protuberances.

Such, at least, is the usual form of this plant, but any one who has examined many examples of it in a living state must be



CYSTOPTERIS FRAGILIS.

(a) Var. ANGUSTATA.

(b) Var. ANTHRISCIFOLIA.

numerous named varieties in two divisions, excluding the typical form, and also the very distinct variety *Dickieana*, to which we shall refer later on. In the first group, *Angustatae*, are placed the narrower pinnuled, often large and inciso-dentate forms, and of these he takes as the

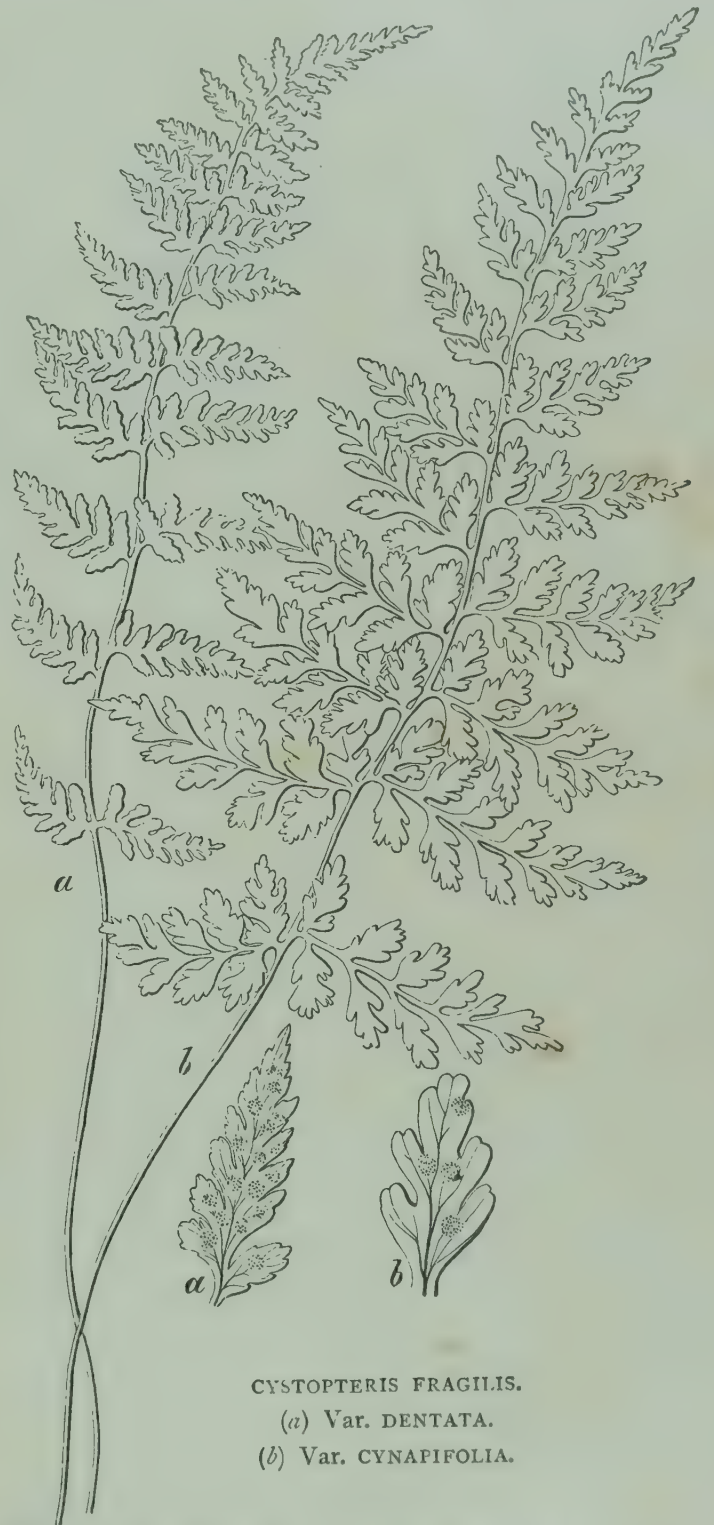
aware of its great variability. Hence has arisen the distinguishing of a great many varieties, several of which are described as species, and to this we owe the very formidable list of synonyms which we find in the "Nature-Printed British Ferns," and elsewhere. In this magnificent work, Mr. Moore groups the



type the var. *angustata* of Smith, who considers this the same as the *Polypodium rhæticum* of Dickson and Bolton, though not of Linnæus. This form is apparently confined to Europe, and is nowhere very common; the "Index Filicum" records it only from Scotland, Germany, and Italy. Our figure shows this plant (the upper specimen), and with it another narrow-pinnuled form, which has been called *C. anthriscifolia*, in which the lobes of the pinnules are notched at the apex; this, however, Mr. Moore does not distinguish from typical *fragilis*. In the second group, *Dentatæ*, are placed the blunter-pinnuled, less-toothed, or blunt-toothed forms, of which *C. dentata*, Sm.—a plant of wide distribution—may be taken as the type. This has small fronds, four to eight inches in length which are sometimes simply pinnatisect, the segments being bluntly toothed, broadly ovate, and less divided, having the sori near the edge. This is given in our upper figure below; the lower one representing a form which has been called *C. cynapifolia*, but which Mr. Moore does not separate from *C. fragilis*. A curious permanent monstrosity (var. *interrupta*) is figured in "Nature-Printed Ferns;" it was found in Westmoreland, by Mr. F. Clowes, and is remarkable for the long intervals between the pinnæ, the fronds thus gaining a curiously-elongated appearance.

Two varieties are so distinct as to require special notice. The first of these, called by Mr. Moore var. *sempervirens*, is a native of Madeira, which is said to have been found both in Devonshire and Kent, some uncertainty, however, attaching to its claims to rank as a British plant. The striking differences presented by this form, which Mr. Moore thinks may be entitled to specific rank, are—its evergreen character, the plant continuing to grow, in a cool greenhouse, throughout the winter, all the other species being quite dormant: the toughness of the stipes as

opposed to the brittleness noticeable in all the other forms, from which, as has been already remarked, the species takes its name; "the greater size of the anterior basal pinnules," and "the glandular hairy vestiture of the indusium, which is conspicuous in the fresh plant." This is the only form of *C. fragilis*—if, indeed, it be not a distinct species—which occurs in the Canary Islands; it is also recorded from Malaga. The other variety, a very remarkable form, is *C. Dickieana*, Sim, which has very broad, blunt pinnules, with rounded overlapping segments, and the general form of the frond oblong. This variety was discovered by Dr. Dickie in a damp cave near the sea near Aberdeen, and has not been gathered elsewhere in



CYSTOPTERIS FRAGILIS.

(a) Var. DENTATA.

(b) Var. CYNAPIFOLIA.



Britain or abroad; it must be therefore regarded as an accidental, or extreme form of *C. dentata*. Milde refers it to the following species (*C. alpina*) as a variety.

The distribution of *Cystopteris fragilis* under one or the other of its forms is a very wide one, as it extends into the extreme arctic regions and up to great elevations, whilst it also grows in temperate climates almost down to the sea-level. It is found especially in the interstices of rocks and stones, and on the sides and tops of the rough walls of hilly districts, and in Great Britain and Ireland is very common in the north, fairly so in the west, and rarer or nearly absent in the southern and eastern counties of England. Throughout northern Europe it is very common, and its range extends north to Iceland and Nova Zembla. It is found in all European countries, but in the south and Mediterranean region it is restricted to mountainous districts; thus in the Sierra Nevada of Spain it attains 10,000 feet, and in Sicily it grows on Mount Etna at an elevation of 9,000 feet. The Fern is found in Cyprus, in the Lebanon, the Caucasus, Persia, most parts of the Russian Empire, Kamtschatka, North China to the Himalayas (where it ascends to 16,000 feet), and other parts of Asia. In South Africa it is frequent, extending north into Natal and Abyssinia. In the New World it extends over the greater part of the North American Continent, where it is very common, reaching far into the Arctic regions, and extending south to California and Mexico. In South America it grows along the whole length of the Andean chain, also in the West India islands, and it is found as far south as Chili. It also grows in Tasmania; and is thus as nearly cosmopolitan as any plant can well be.

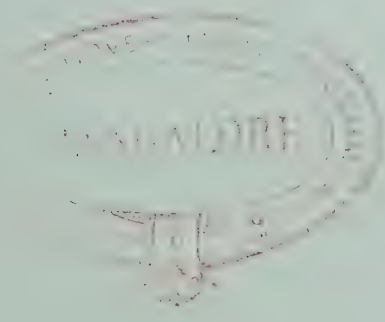
#### CYSTOPTERIS ALPINA, Desv.

By many good botanists this is not considered specifically different from the last, *C. fragilis*; even Prof. Babington, in the last edition of his "Manual of British Botany," places it, "with much doubt" certainly, under that species. We, however, rather follow the opinion of Sir W. J. Hooker, who considered it a good species, and maintained it as such in the "Synopsis."

The caudex and form of the fronds do not differ much from the last, but the stipes is less brittle and juicy. The fronds are bipinnate or almost tripinnate; the ultimate divisions being deeply cut, very fine, narrow and linear, obtuse and slightly notched or cloven at the end, and from their number and close arrangement they give a crisped appearance, reminding one of the Parsley-Fern. A character requiring, however, minute examination, is relied upon by some botanists to distinguish this species from the last in the veinlet of the segments, which in this terminates in the notch just alluded to, whilst in *C. fragilis* the veins run to the termination of the teeth.

This species is a rare one, and has a distribution of limited extent, chiefly in Southern Europe and Asia Minor. It is found in the Pyrenees, near Gavarni, and is not unfrequent in the Swiss Alps; it also occurs in the Jura. There are several localities in Spain and in Italy, also in Styria and Dalmatia, and this range extends to Greece, the Cilician Taurus mountains and Syria. The Greek plant of Mount Taygetus at 5,000 feet, called *Aspidium taygetense*, appears to be referable to this species. Britain seems to lie rather beyond the natural boundary of this beautiful Alpine Fern, but *C. alpina* has had a place in our Floras. It grew for many years on one or more garden walls in the village of Low Leyton, Essex, where it seems to have been first recorded about 1788. In the early part of the century it was abundant there, and was certainly gathered there so recently as 1840 or 1841. In 1861 it was searched for in vain, and is probably now extinct in the locality where it could not have had any claim to be considered native, but had been no doubt introduced. The other British localities are all doubtful,





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Vincent Brooks, Day & Son Lith

ADIANTUM. (MAIDENHAIR FERN.)

1. ADIANTUM CAPILLUS VENERIS. 2. ADIANTUM ÆTHIOPICUM (TWO THIRDS NATURAL SIZE)

1A. PINNULE IN FRUIT. 2A. PINNULE IN FRUIT. (NATURAL SIZE)



but Professor Babington gives "Teesdale, Mr. J. Backhouse" with certainty, which locality, so rich in rare plants, should be carefully examined for the plant. Mr. Backhouse is said to have gathered it there in 1872.

*C. alpina* is not, as here understood, very variable, and may always be readily known by its long narrow segments as described above.

### CYSTOPTERIS SUDETICA, *A. Br. & Milde.*

This species of Bladder-Fern was only made known to botanists in 1855, and has been found as yet in but few localities. The frond is larger than that of *C. fragilis*, and though like it in texture, in form it more approaches the next, *C. montana*. Its rhizome is creeping and branched, set at the end with short ovate paleæ, which have the margins entire. The fronds are from twelve to fifteen inches in length, more than half of which length is occupied by the slender, smooth, delicate stipes, which has scarcely any scales upon it. The frond itself is triangular, the lowest pinnæ being the longest; it is about six inches in length and the same wide; the pinnæ are distant and wide-spreading, oblong-lanceolate, acute, and tapering to a slender point, and are divided into ovate distant pinnules, which are very deeply cut into oblong blunt or wedge-shaped segments with several small teeth at the end. The sori are small, few, and distant, close to the edge of the segments, and the indusium is densely glandular. The spores are minutely tubercled.

This species is a native of mountain woods at 6,000 feet elevation and lower, in several places in the Sudetes mountains of Moravia; it has also occurred in Transylvania, Galicia, and several parts of the Carpathian chain, and has been found in Eastern Siberia near Yakutzk. The plant varies like the rest of the genus in the width of the segments of the pinnules.

### CYSTOPTERIS MONTANA, *Bernh.*

This rare and beautiful species is quite distinct from the rest of the genus to which it belongs, and indeed presents a strong similarity to *Polypodium Robertianum*. Its rhizome is long and creeping, nearly black, and covered with large yellowish paleæ in the younger portions, the fronds being given off at longish intervals. The stipites are slender, erect, rather wavy, longer than the fronds, and provided very sparingly, chiefly below, with scattered lax ovate acute scales. The fronds are distinctly triangular in outline, about four to six inches in length, and about the same in breadth at the base, the two lowest pinnæ are very much the longest, all are wide-spreading, and the frond rapidly tapers to an acute point; the pinnules are ovate-oblong, spreading, acute, or tapering, markedly alternate, and those on the lower side of the pinnæ, especially of the two basal pinnæ, are very much larger than those on the upper, so that the pinnæ are strongly lop-sided; the pinnules are again divided into tertiary leaflets, which are ovate and very deeply cleft nearly to the base into broadish pinnatifid segments, with two or three acute teeth at the end of each division. The sori are small, and arranged in two lines, one on either side of the tertiary divisions; the indusium is ovate acute, sometimes toothed near the top, and smooth, but in old specimens it often becomes shrivelled and reflexed, and requires careful examination for its detection.

There is not much variability in this beautiful species, the chief difference in plants from various localities being in their size. This is noticeable in the English, or rather Scotch specimens,



which seldom attain the dimensions given above, the frond being usually nearer three than four inches in diameter, and similar small specimens occur from other localities.

*C. alpina* is one of our rarest alpine species, and has only occurred in a few localities in the highest of our Scotch mountains. It was discovered on Ben Lawers, in 1836, by Mr. W. Wilson, and has been since collected in Glen Lyon, Glen Lochay, and a few other spots in the Breadalbane Mountains. We have also seen specimens from the head of Glen Callater, Braemar, in Aberdeenshire, and from Glen Islay in the Clova mountains in Forfarshire. Tracing the distribution abroad, we find this fern fairly abundant in the mountainous parts of Scandinavia, extending into Finmark; and it occurs in most of the mountain chains of Europe, the Pyrenees, the Swiss Alps, the Tyrol, the Carpathians, and the Apennines. It has also been found in France, in Dauphiné, and in the Jura, and shows a special predilection for calcareous rocks. In Eastern Europe it does not occur, nor is it met with in the whole Asiatic Continent, with the exception of Kamtschatka. It, however, puts in an appearance in North America in the Rocky Mountains, especially their eastern side, and is also found in Labrador. In all its localities *C. montana* may be considered to be a rare species.



CYSTOPTERIS MONTANA.



## PTERIS.



ACCORDING to the authors of the "Synopsis Filicum," this very large genus contains 100 species, and is represented more or less fully in almost every part of the world. They are for the most part large ferns, varying a good deal in habit and in the divisions of the frond, the rhizome being creeping or partly erect. Several representatives of the genus have long been inhabitants of our greenhouses, but some of these are natives of Europe, which will be considered at length further on. It is remarkable that nearly all the variegated ferns in cultivation belong to this genus; the best known and most popular of them is the variety of *Pteris cretica* which is known in gardens as *albo-lineata*, in which a broad and strongly marked band of white runs up the centre of each pinna. A species of wide distribution in both hemispheres—*P. quadriaurita*—produces two very striking varieties, which have been figured and described as species: the first, *P. argyræa*, like the variety of *P. cretica* mentioned above, has a more or less distinctly marked band of white running down the centre of the frond; this is an East Indian plant: the other, *P. tricolor*, is one of the most striking of variegated plants, whether ferns or otherwise; the centre of each pinna is of a bright rosy-red, with a margin of white, both being set off by the bright shining green of the other portion of the frond; like the last, this is a native of the East Indies.

One of the most common extra-European garden species is *Pteris serrulata*, a common plant in China which has recently been detected in Japan and Natal. It was introduced in 1770 by Mr. James Gordon. It is from a foot and a half to two feet high, with ovate pellucid bipinnate fronds, the pinnæ (especially the terminal ones) being much elongated. This peculiarity is remarkably developed in a recently introduced variety known as *P. serrulata Leyi*, in which all the pinnæ are contracted into slender serrate tails. This is the species which has been already alluded to in our introduction as affording an example of non-sexual reproduction from the prothallium.

## PTERIS AQUILINA, Linn. THE BRACKEN.

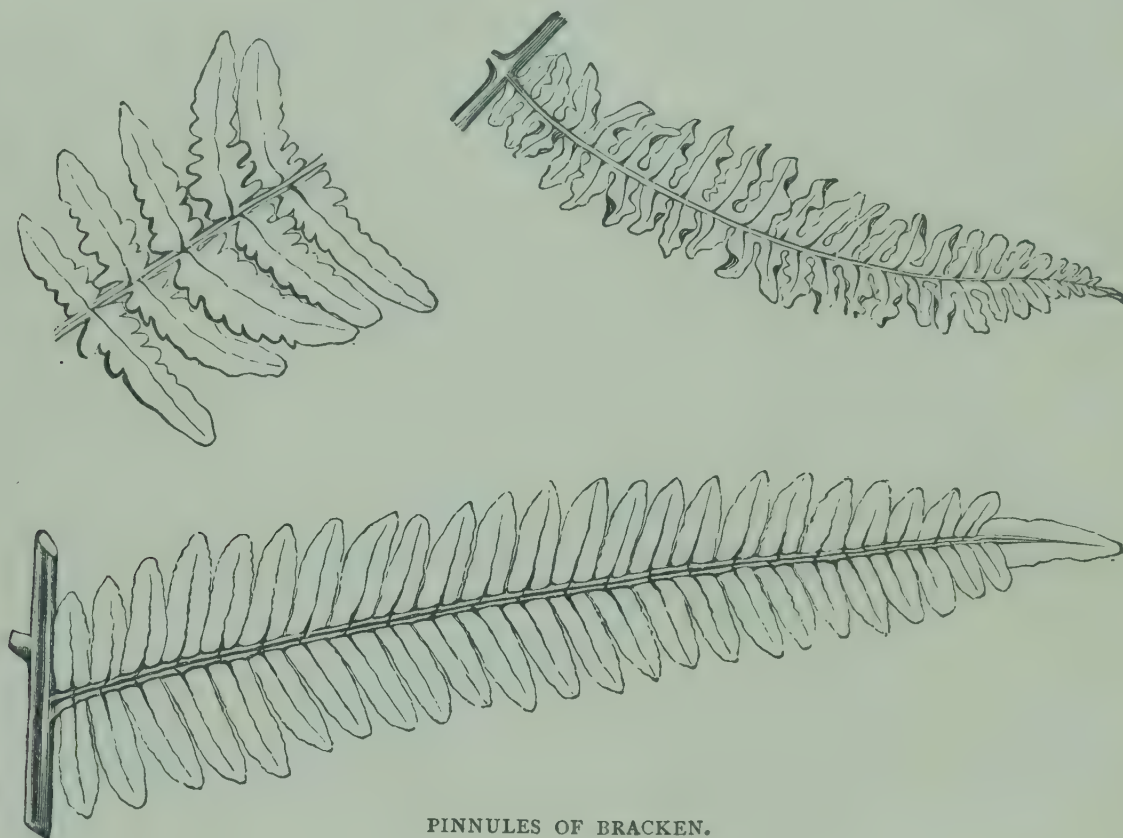
This is the commonest and most familiar of all Ferns, and attracts but little attention even from the lover of these plants, though its large size, remarkable structure, and bright fresh colour render it a very notable species.

The Bracken has a subterranean branching rhizome or caudex creeping for a long distance, and giving off irregularly numerous slender dark-coloured root fibres; it attains a diameter of nearly half an inch, is white within but externally brown, being densely covered with a fine close, velvety coat of short dark hairs; there are no scales or paleæ. The depth beneath the surface of the soil at which the rhizome runs is usually 3 or 4 inches, but it is said sometimes to "dip deeply and almost perpendicularly" to a depth of as many as 15 feet, and it grows with great rapidity. The fronds come off either rather closely or at longer intervals; when first appearing above ground they are remarkable in having the whole leafy portion bent over and pressed closely to the stipes. This latter is about half the length of the frond, and quite erect; it shows a remarkable difference between the portion beneath the ground connected with the caudex



and that in the air; the former is considerably swollen, rounded, and covered like the caudex with the same dark brown fine felt, but it tapers again at the very base; the upper part is quite smooth and shining, yellowish green or pale orange, flat above but much rounded beneath, and when mature rather sharply angular. The stipes is not articulated with the caudex, but after withering the lowest part remains attached to it.

On a section through the stipes, especially through the thickened lower portion, the familiar "eagle" or "oak-tree" is brought into view. This is formed by the fibro-vascular bundles, which are ten to twenty in number, being arranged in a singular way round the central dark mucilaginous portion. The fronds are among the largest of our native species, and, with the stipes, attain under favourable circumstances, 8 or over 10 ft. in height; 3 or 4 ft. is a more usual height, and when grown on very poor or rocky soil the whole frond is sometimes but a few inches high. The



PINNULES OF BRACKEN.

general form of the leafy portion is nearly triangular, especially in small specimens; in large ones the triangle is drawn out so as to be somewhat oblong, the two lowest pinnæ are, however, always much the longest; the composition is either bipinnate or tripinnate, and the rachis stiff, hard, shining, and deeply channelled on the upper surface. The pinnæ are very large, always opposite, ovate or oblong-ovate in outline, and distantly placed; their pinnules are alternate, closely placed, linear-oblong, but gradually tapering from the broad base, acute or drawn out into a long point. Each pinnule is divided into sessile, spreading, triangular-ovate, or oblong, or nearly linear segments, blunt at the end, and either quite entire at the edge, more or less wavy, or, the lower ones especially, further divided into blunt, oblong, or triangular lobes: these variations are shown in the above figures. The frond is smooth above, but covered beneath with fine white hairs; its texture is thick and leathery, and the colour bright pale green. The central vein in each segment is strongly marked; the lateral ones are faint and fine, and usually twice forked before reaching the margin, where they fall into a fine marginal vein which extends round the whole segment.











When the frond is fertile the margin of the segments is strongly and stiffly recurved, and the doubling back is continued by a delicate membranous curtain continuous with the edge of the segment; this is by some authors considered an indusium, by others as a portion of the frond, and it may be termed a false indusium. It covers the sporangia, which are arranged in a continuous line of sori along the whole length of the marginal vein above noticed, and it is worthy of particular remark that there is beneath the line of fructification a second membrane similar to, but shorter than, the first, and concealed by the sporangia; both membranes have a delicate fringe of hair-like processes. The lower one must be considered as a true indusium, and its presence distinguishes *P. aquilina* from the other species of the genus here described; it is said, however, to be sometimes absent. The spores are yellow, slightly granular, and tetrahedral-globose in shape. The peculiar double indusial membrane has led some botanists to make a separate genus of this plant, and it has been named *Eupteris* by Newman, and *Ornithopteris* by Agardh.

It is scarcely an exaggeration to say that the Bracken is found all over the world, for, with the exception of the extreme north and south, this is almost strictly the case. The Fern, however, puts on a rather different appearance in different parts of the globe, and the list of names which it has consequently received is very formidable; most of them are given in Hooker's "Species Filicum:" yet, considering the very great extent of its distribution, it cannot be considered a very variable species. The following are the varieties recognised by Hooker in the work above referred to:—1. *glabra*, with the fronds smooth or but slightly downy beneath. This is abundant in Europe, North America, and North Asia, and extends into South Africa, South China, Java, the Pacific Isles, and Brazil. 2. *lanuginosa*, with the fronds silky-tomentose beneath, and the pinnules more regularly pinnatifid: this is even more widely distributed, and is especially common in hot countries, as throughout tropical Africa, India, Penang, Sandwich Islands, Mauritius, Jamaica. 3. *caudata*, a West Indian and Central American form, with narrow linear segments, with the false involucres nearly meeting across the smooth back. 4. *esculenta*, which also has remote linear pinnules often running together, and decurrent, narrow, coriaceous, and smooth; the decurrent base usually forms a rounded lobe or short wing to the rachis; this is the common form in the Southern Hemisphere, and is often reckoned a separate species; it is abundant in Australia, New Zealand, and Norfolk Island, and is found in the Feejees, tropical America, the West Indies, and rarely in India.

In this country *P. aquilina* grows abundantly in all suitable spots, and forms a familiar feature of English scenery. For its due growth in luxuriance a fairly deep and light soil is necessary, and hence, probably, it is a rarer plant on chalky and limestone formations than in other districts. Heaths, borders of fields, and especially open places in woods or forest lands, are the favourite habitats of the Bracken. The range in altitude in this country has been found to agree very closely with corn cultivation, and *Pteris* is thus never an alpine plant. In no parts of the Scotch Highlands does it reach higher than 1,900 or 2,000 ft., and it has been employed by geographical botanists as a convenient test of elevation and boundary line between alpine and non-alpine vegetation.

Passing by slight varieties, a few words must be said about a puzzling little fern frequently met with in wet seasons in the chinks of brick walls and similar places, which has been mistaken for Maidenhair more than once. It is usually but a few inches high, very delicate in texture, with the frond slightly divided into wide segments, and never produces any fructification. This is nothing but the young "seedling" state of the Bracken, the spores of which have germinated in an unsuitable position; such little ferns are often seen on walls in cities; thus on the Tower



of London a few years back it was abundant, as recorded in the "Flora of Middlesex." The same form comes up frequently in hot-houses. Occasionally it develops into a large plant, while still retaining its juvenile characters, and then presents a very singular appearance; in this form it is sometimes met with in woods, where it attracts attention by its delicate texture. Specimens in the Herbarium of the British Museum, collected by Mr. T. Kirk at Coventry, grew profusely over the floor (composed of mortar) of a deep pit excavated for a swimming bath; in this situation the fronds attained four feet and upwards in length, but were unable to bear their own weight; they were barren and very delicate, transparent and pale green, with broad segments: the rhizomes were from six to ten inches long. It is certain that the recently published new Scotch species, *P. gracile*, Paterson,\* is nothing but this, and its author has unfortunately added but one more to the already almost innumerable names for this species.

The only part of Europe where the Bracken is not found is the extreme north; in Lapland it does not extend beyond quite the southern part, and is there very rare.

The Bracken has, perhaps, more claims to be considered of economic value than any other species of Fern, and it has certainly been employed in a variety of ways. It has been proposed as an article of food; and the rhizomes of the closely-allied species or variety (*P. esculenta*) were formerly largely employed in New Zealand by the natives. The Rev. M. J. Berkeley obtained by peeling and scraping some of the rhizomes of our common Bracken a pulp, which, after careful washing and drying, was kneaded into a cake and baked, the result being a coarse but palatable food, somewhat resembling cassava-bread. In Siberia and Lapland—some say also in Normandy—it is sometimes mixed with bread or brewed in ale, one-third of the rhizomes going to two-thirds of malt in the latter case; and in the Canary Islands also a kind of bread is made from the rhizome. The green fronds in the young unexpanded state are in some parts of England used as food for pigs, and in some parts of Wales the dry fronds are chopped up in winter with straw and hay and given to horses. Mr. Benjamin Clarke suggests the employment of the very young fronds as a substitute for asparagus. They should be cut as soon as they first begin to appear above the ground, and as low down as may be; when quite blanched they must be boiled for an hour, or rather longer if at all tinged with green, the leafy part, if any be present, being in all cases rejected. A sufficient quantity of salt must be added to the water, so that the vegetable may gain a slightly saline taste. When at all green, the cooked fronds retain a somewhat harsh and herbaceous flavour, not unlike that of tea; but this is hardly perceptible in the blanched fronds. They are slightly astringent, and the proposition for thus employing them does not appear to have been at all generally taken up. Thunberg tells us that in Japan the young fronds form an article of diet, and that bundles of them are exposed for sale in the shops during the months of April and May. The rhizome is bruised, soaked in water, and boiled, and though quite black, is or was formerly eaten by the poorer Japanese.

In many parts of Great Britain the Bracken is in great request for litter for horses; and in some parts of Wales it is chopped up when dry and mixed with hay or straw, and then given to them as food. In Scotland it is often used for thatch, the stalks being the part most frequently employed, being bound down with ropes of heath or birch-bark. Its use in this manner in England dates very far back; in a statute of Edward the Third, dated 1349, it is enacted that every tiler or coverer with straw or fern shall receive threepence a day, their servants or knaves twopence a day, and their boys three-halfpence a day.

The ashes of the Bracken contain a large amount of alkali, which has been turned to useful account in the Western Isles of Scotland, and in some of the mountainous districts of

\* "Clydesdale Flora," ed. 2.



Wales. The dried fern is burned in large heaps, and, sufficient water having been sprinkled on the ashes to make them adhere together, they are rolled into round balls about two inches in diameter. When quite dry, they are sold at from threepence to eightpence a dozen, being used in wash-houses to save soap. Having been heated to a red heat, they are taken out of the fire and thrown into a tub of water, which soon becomes a strong lye, and is then fit for use. This method of employing the Bracken is of considerable antiquity. Parkinson, writing in 1640, says, "They use in Warwickshire, above any other country in this land, instead of sope to wash their clothes, to gather the female ferne (for that is most frequent with them) about midsomer, and to make it up into good big balls, which when they will use them they burne them in the fire, untill it become blewish, which being then layd by, will dissolve into powder of itselfe, like unto lime: foure of these balls being dissolved in warme water is sufficient to wash a whole bucke full of cloathes." The Bracken was called by the older writers the Female Fern, in Latin *Filix fœmina*, the Male Fern being that which still retains the title (*Aspidium Filix-mas*). The two are contrasted by Lyte, who says, "There be two kindes of fernes (as Dioscorides writeth) the male and the female."

The ashes of the Bracken have also been used by glassmakers. In some parts of Switzerland the alkali is obtained for commercial purposes. The fronds are cut about the end of June, when they have arrived at about half of their full development, as it is then that they contain most potash. They are allowed to become half dry, and a pit is then dug into which the fern is cast; it is then burnt very slowly, care being taken to prevent a flame. A good deal of attention is requisite to obtain satisfactory results, but this is a point upon which experience is needed, as no definite rules can be laid down. When the whole is burnt, the ashes are collected, and are sold either in that state, or after a further preparation by which the pure salt is obtained. The plant is also employed in various parts of the country for thatching or as fuel, and especially in packing fruit for the markets, a purpose for which it seems peculiarly suited. We find mention in Machyn's Diary (1552) of a man who was convicted of selling "potts of straberries, the whych the pott was not alff fulle, but fylled with forne," and one of its French names is *fougère à cerises*, in allusion to its use in packing cherries for the market; so that the employment of Bracken in this capacity is both ancient and extended. The rhizomes are said to be eaten in winter by swine in the New Forest; but they are considered poisonous to cattle in general, and in some parts of Scotland are suspected to be the cause of a disease in sheep known as the "trembles."

The Bracken was in old times extensively used in medical practice, although this is scarcely remarkable, as every plant was accredited with numerous "vertues" two hundred years or so since. Besides its use, in common with almost all other ferns, as an anthelmintic, it was considered to possess healing qualities; "the rootes," says Parkinson, "being bruised and boyled in oyle or hogs grease, maketh an oyntment very profitable to heale woundes, punctures, or prickles in any part." The following "vertue," from the same author, is somewhat amusing:—"The fume of ferne being burned driveth away serpents, gnats, and other noisome creatures, that in the fenny countries much molest both strangers and inhabitants that lye in bed in the night time with their faces uncovered." Langham, in his "Garden of Health" (1633) gives nineteen distinct "vertues" pertaining to fern, from which we select the following, as showing the varied uses to which our predecessors applied the plant:—"Nose bleeding, the roots staunch bloud, and heale the wound . . . . Chop a basket full of fearn and seeth it in a bag in the third part of a tun of water, and bathe therein to restore the strength of the sinews . . . . The leaves of both fearns put into bedstraw, driveth away punises [fleas], and all other such wormes . . . . The powder of brakes doth heale dangerous sores both of men, kine, swine, &c."



From an entry in the household book of the Earl of Northumberland (1511), it appears that "water of braks" was distilled every year for domestic use. At a much later period even, the odour of fern was considered beneficial; in a MS. upon the Natural History of Wiltshire, by John Aubrey, in the possession of the Royal Society, we read that "Dr. Theodore Mayern did prescribe to his patients that had hecticke feavers, to lay a stratum of ferne on their under-blanket, by which they found much benefit; the frescheur of the ferne was moderately cooling, and the sent of it is very gratefull to the braine." Gerard says that "it is reported that the roote of ferne cast into an hogshead of wine keepeth the same from sowing."

The Bracken is the plant usually intended under the name of "fern" in poetical works, as when Cowper speaks of

"The common overgrown with fern, and rough  
With prickly gorse:"

and Burns refers to it by its other common name when he says,

"Far dearer to me yon lone glen o' green breckan,  
Wi' the burn stealin' under the lang yellow broom."

Breckan would seem, however, to be a Scotch name for ferns in general: it scarcely applies to *Pteris aquilina* in Tannahill's lines

"Round the sylvan fairy nooks  
Feathery breckans fringe the rocks."

The Bracken is also the fern with the seed of which the gift of invisibility, referred to by Shakespeare and other old writers, was especially connected. It seems likely that the notion arose in an application of the "doctrine of signatures," according to which plants were supposed to bear some resemblance to the disease or purpose for which they might be beneficially employed. As far back as the time of Pliny, it was thought that the fern produced neither flower nor seed; but as, in spite of this, it grew and multiplied, it was inferred that seed must be produced, although invisibly, and hence it came to be associated with the gift of invisibility. Locally, however, there are legends which suppose that the Bracken, in olden time, did produce blossoms; thus, in Lincolnshire, it is said that until the Nativity it bloomed like other plants, and that it formed part of the cattle-bedding in the stable at Bethlehem, associated with the Lady's Bedstraw. The latter plant put forth its blossoms in honour of the miraculous event, while the Bracken withheld them, and was hence condemned to lose them. In some parts of Shropshire it is said that the Bracken puts forth a small blue flower on Midsummer eve, which disappears with the first dawn of day; and the Russian peasants also believe that it blossoms at this time, and that the finding of the flowers brings luck. It was formerly believed in Scotland that this fern blossomed on St. John's eve, and that whoever got possession of the flower would be protected from all evil influences, and would obtain a revelation of hidden treasure.

Midsummer eve was the period at which it was generally supposed the mystic fern-seed could be collected, and the accompanying gift of invisibility ensured.

"On St. John's mysterious night,  
Sacred to many a wizard spell,  
The time when first to human sight  
Confest the mystic fern-seed fell:  
Beside the sloe's black knotted thorn,  
What hour the Baptist stem was born—



That hour when heaven's breath is still—  
 I'll seek the shaggy fern-clad hill,  
 Where time has delved a dreary dell,  
 Befitting best a hermit's cell;  
 And watch, 'mid murmurs muttering stern,  
 The seed departing from the fern,  
 Ere wakeful demons can convey  
 The wonder-working charm away,  
 And tempt the blows from arm unseen,  
 Should thoughts unholy intervene."

Occasionally, however, though rarely, another date was selected; Mr. Kelly\* tells us that in Swabia they say that fern-seed brought by the devil between eleven and twelve o'clock on Christmas night enables a man to do as much work as twenty or thirty ordinary men. In France it was formerly believed that internal disorders of all kinds would be cured if the patient wore on his person a girdle of ferns, gathered at midnight on St. John's eve, and so arranged as to form the mystic letters HVTY. The use of this girdle was condemned by a Synod held at Bordeaux in 1600; and a similar assembly at Ferrara in 1612 censured any one who should collect either ferns or fern-seed on the night preceding the day of St. John Baptist.

Turner, our earliest writer upon English plants, gives the evidence of a German contemporary to show that ferns really did produce seed on Midsummer eve, but there is an amusing air of mystery about his account. Premising that a "Christen Phisicion, named Hieronymus Tragus, doth not onelye saye that Ferne hath sede, but wrytith that he founde upon mydsomer even sede upon Brakes," he proceeds to translate his words as follows:—

"Although that all they that have writen of herbes have affyrmed and holden that the Brake hath nether sede nor frute: yet have I dyvers tymes proved the contrarye whiche thinge I will testefye here in this place for there sakes that be studentes in the knowledge of herbes. I have foure yeres together one after an other upon the vigill of saynt John the Baptiste (whiche we call in Englishe mydsomer even) soughte for this sede of Brakes upon the nyghte, and indede I founde it earlye in the mornynge before the daye brake; the sede was small blacke and lyke unto poppye. I gatherid it after this maner: I laide shetes and mollen leaves underneth the brakes whiche receyved the sede that was by shakynge and beatynge broughte oute of the branches and leaves. Manye brakes in some places had no sede at all, but in other places agayne a man shall fynde sede in everye brake, so that a man maye gather a hundred oute of one brake alone, but I went aboute this busynes, all figures, conjurynges, saunters, charmes, wytchcrafte, and sorseryes sett a syde, takynge wyth me two or three honest men to bere me companye. . . . Sometye when I soughte the sede I founde it and sometye I founde it not. Sometye I founde muche and sometye lytle; but what shoulde be the cause of this diversyte or what nature meaneth in this thinge, surelye I can not tel."

That "figures, conjurynges," and the like, were associated with the gathering of fern-seed we gather from a very explicit account of the *modus operandi* formerly pursued in Staffordshire. Having arrived at a suitable spot, a circle was drawn round the would-be gatherer, in which the twelve signs of the zodiac were inscribed; twelve pewter plates, one within another, were then to be placed under the fern, and the following distich recited:—

"In the holy name of Jesus may I be freed  
 From every harm while gathering Fern-seed."

After this, silence was to be observed until one o'clock, nor must the circle be quitted; the seed will then be found in the twelfth plate, having passed through the eleven others.

In Surflot's "Countrie Farme" (1600) there is a passage which shows that fern-seed could be collected at home, without the necessity of exposure to the perils which sometimes attacked

\* "Curiosities of Indo-European Tradition and Folk-lore," p. 193.



its would-be possessor. Surflet says it is ripe "in the end of July," and adds: "For to gather it you must cut the leafe neere unto the roote, and then hang them up in your house, spreading a linnen cloath under them, or else some faire, cleane white paper: I knowe well that the common sort doe verily thinke and averre, that this seede cannot be gathered but on the night of the wake of S. John in sommer, and that more is, not without great ceremonies and mumbling and muttering of many words betweene the tecthe, which have power to drive away divels, which have the custodie of the same seede: but all this is nothing but fables."

In Russia the belief in the midsummer flowering of the fern is in full force, as may be seen in Prof. De Gubernatis's "*Mythologie des Plantes*." It is said that the man who finds the flower will acquire boundless wisdom; but the flower is only to be found for a single instant at midnight, and it is necessary to conquer the evil one himself before the blossom can be seen. This must be done in the following manner: on the appointed night he who dares to attempt the enterprise must select the particular fern which he desires to see flower, and must place near it the towel which he used on Easter-day. He must then, with a knife which he used on the same feast, trace a circle round the fern and round himself. At nine o'clock in the evening the devil will attempt to terrify the Christian, throwing at him stones, wood, and other heavy missiles; but the watcher is exhorted to remain calm and to show no symptom of terror, as the evil one has no power to enter the magic circle traced by the knife. At the hour of midnight, the fern blossoms, and the flower falls upon the towel, which the Christian must instantly seize and conceal in his bosom. The fortunate possessor, thanks to this possession, will know things present and things to come, and will be able to discover hidden treasures or lost cattle. In illustration of this belief a story is told in Russia of a countryman who had lost his oxen upon the eve of St. John. In prosecuting his search for them, he crossed a wood, and passed close to a fern at the very moment of its flowering, and the blossom fell into his shoes. He immediately became acquainted with the place where the cattle were hidden, and, going to it, recovered them, and took them with him. The fern-blossom still remaining in his shoes, he became aware of a certain place where a treasure was hidden, and told his wife that he would go and find it. "Change your shoes," said the good woman, seeing that his stockings were damp; he unfortunately followed this advice and took off his shoes; at the same moment the flower of the fern fell to the ground, and he forgot all about the discovery of the treasure! In another version of the same story it is stated that the devil, in order to deceive the peasant, offered to give his boots in exchange for the wretched shoes of the countryman; the latter consented to the bargain, and, giving up his shoes, lost all knowledge of the treasure he was about to seek.

It would be interesting to ascertain whether the gathering of fern-seed is still observed in any part of England. Brand says that at Launceston, in 1790, some rites connected with it were still in use, and also in Heston, in Middlesex, towards the close of the last century. The connection of fern-seed with Midsummer-day is to be found in the fact that June 24th is the day set apart by the Catholic Church for the commemoration of St. John the Baptist; a passage in Dr. Jackson's "*Works*" (1673) states, on the authority of "an ignorant soul," who "had been seduced by a teacher of unhallowed arts, to make a dangerous experiment," that "the angel did foretell John Baptist should be born at that very instant in which the fern-seed, at other times invisible, did fall." The danger of engaging in the collection of fern-seed was not trifling, if we accept as accurate the account of a person who went out for that purpose, and was assailed by the spirits, who "whisked by his ears like bullets," and struck him on his hat and on various parts of his body; while, worse than all, he found the box, in which he thought he had secured the



coveted treasure, quite empty on his return home. The gift of invisibility was sometimes conferred upon those who came into possession of fern-seed without any desire of their own. Thus Grimm tells as current in Westphalia a tale of a man who went out on Midsummer night to search for a foal which he had lost, and who, on his way, passed through a meadow just as the fern-seed was ripening, some of which fell into his shoes. When he went home and sat down, neither his wife nor any of his family noticed him, which he thought strange, and proceeded to say "I have not found the foal." On this, all those in the room started, for they heard the voice, but saw no one. His wife, thinking he had hidden himself, called to him, whereupon he placed himself in the middle of the room, saying "Here I am, right before you; what do you want?" This frightened them still more, for they had heard him stand up and walk, and yet saw nothing. At last, becoming aware that he was invisible, the thought struck him that he might have fern-seed in his shoes, and on taking them off he at once became visible to those around him.

Various traditions connected with ferns and fern-seed are to be found in different parts of Europe. Thus in Poland it is said that a thunder-storm will follow if ferns be gathered; in Thuringia it is said that whoever treads on it unawares will lose his senses, and be unable to tell where he is, and also that anyone carrying fern about with him will be pursued by serpents until he throws it away. In the north of Hungary it is supposed that whoever comes too near the flowers of fern will be overcome with sleep, and that spirits repulse all who dare to lay hands upon the plant. So much for the unfavourable aspect of ferns, to which we may add the opinion of the natives of our own "Black Country," who think it unlucky to gather or even to touch ferns, and call them the devil's brushes. A quaint letter to the High Sheriff of Staffordshire, from a British Museum MS. which was published in an early volume of "Notes and Queries," is worth reprinting here, as illustrating a curious seventeenth century belief, from which Charles I. was not free. It runs as follows:—

"Sir,—His Majesty taking notice of an opinion entertained in Staffordshire, that the burning of Ferne doth draw downe rain, and being desirous that the country and himself may enjoy fair weather as long as he remains in those parts, His Majesty hath commanded me to write unto you, to cause all burning of Ferne to bee forborne, until his Majesty be passed the country. Wherein not doubting but the consideration of their own interest, as well as that of his Maties, will invite the country to a ready observance of this his Maties command, I rest,

"Your very loving friend,

"PEMBROKE AND MONTGOMERY.

"Belvoir, 1st. August, 1636."

It seems that in some parts of Scotland there is a generally received opinion that burning the heather will bring rain.

On the other hand there are some local beliefs in which the fern figures as a lucky plant. Mr. M. D. Conway says that in Bohemia the traveller will take fern-seed along with him for good luck; and here, as in the Tyrol, the seed is said to shine like fiery gold upon Midsummer night. In early times fern-seed was called "wish-seed," and he who held it would find hidden treasures which, where the seeds were scattered, would reveal themselves in veins of bluish flame in the earth. In Bohemia a cloth used in administering the Holy Communion should be laid under the fern, on which the seed will fall before sunrise. Other superstitions connected with the Male Fern and the Flowering Fern will be found in their place.

One or two proverbial sayings are associated with the Bracken in different parts of England, of which the following is perhaps the best known:—



"When the fern is as high as a spoon,  
 You may sleep for an hour at noon :  
 When the fern is as high as a ladle,  
 You may sleep as long as you're able :  
 When the fern begins to look red,  
 Then milk is good with brown bread."

If the rhizome of the Bracken be cut across, it will be seen to display dark irregular markings, which have been very differently interpreted. They have been supposed to represent a double-headed eagle, an interpretation which seems to have originated in Germany, and is of considerable antiquity; for we find in "The Pilgrimage of Pure Devotion," one of the colloquies of Erasmus, a reference to an imaginary likeness of a toad in the Crapaudine, or Toadstone, "even as we suppose when we cutte the fearne stalke there to be an eagle." Our old herbalists also mention the resemblance. It was in allusion to this likeness that Linnæus bestowed the name *aquilina* (from *aquila*, an eagle) upon the plant. Others detect in the markings a branching oak, which, according to some, commemorates the concealment of Charles II. in the oak after the battle of Worcester. A perfect representation was considered lucky; at least, so says a correspondent of "Notes and Queries" (1st series, vii. 152), who gives as a piece of Surrey folklore, "Cut a fern-root slant-wise, and you'll see a picture of an oak-tree: the more perfect the luckier chance for you." A more pious, though equally fanciful, tradition discovers the initials "J. C.," standing for Jesus Christ; an idea far-fetched and strange enough to the minds of the nineteenth century folks, but not unreasonable to those who in bygone times loved to trace such analogies between the kingdom of grace and the kingdom of nature. The letters were, however, sometimes interpreted as possessing a very different signification; in Sussex it is said that the initials of the name of a future husband or wife may be ascertained in this manner. In some parts of Scotland it is said to be the mark of "the deil's foot."

It is not often that the muse has honoured any member of the fern tribe with more than a passing reference; we have, therefore, no hesitation in including in our notice of the Bracken the following graceful lines, addressed to it by Miss Mary Isabella Tomkins:—

"As a coming screen grows the Bracken green,  
 Up springeth it fair and free,  
 Where in many a fold, grotesque and old,  
 Twineth the hawthorn tree;  
 A covert meet from the noontide heat,  
 For should you steal anear,  
 You may chance discern, 'neath the spreading fern,  
 The antlers of the deer.

It boasteth a name of mystic fame,  
 For who findeth its magic seed  
 A witching and weirdly gift may claim  
 To help him at his need :  
 Unseen, unknown, he may pass alone  
 Who owneth the fern-seed spell;  
 Like the viewless blast, he sweepeth past,  
 And walks invisible!

Have ye to learn, how the Eagle fern  
 Doth in its heart enshrine  
 An oak-tree like that which the hunter Herne  
 Haunted in days 'lang syne?









A. PTERIS LONGIFOLIA (L.) B. PTERIS ARGUTA (Ait.) C. PTERIS CRETICA (L.)



An oak-tree small is repeated all  
Complete in branch and root,  
Like the tree whereunto King Charles did flee,  
When press'd by hot pursuit.

To his son its shade gave but traitor aid  
When, striving to be conceal'd,  
On foot he fled, in fear and dread,  
From Sedgemoor's fatal field;  
In doubt mean was a peasant seen,  
Wearing a priceless ring—  
He whom the voice of the people's choice  
So late had hailed their King.

O Eagle fern! when I thee discern,  
When thy withered leaf I meet,  
In places the careless foot might spurn,  
The crowded mart or street,  
Thou takest me back to thy birth-place fair,  
Where thou wavest in thy pride,  
And the form of the hare and the deer's close lair  
Doth 'mid thy stems abide."

In reclaiming forest land, it is often necessary to destroy Bracken, and this may be efficaciously done by repeated mowings. Tusser ("Five Hundred Pointes of Good Husbandrie"), under "August's Husbandrie," writes:—

"Get downe with thy brakes, er an showers doo come,  
That cattle the better may pasture have some.  
In June and in August, as well doth appeere,  
Is best to mowe brakes, of all times in the yeere."

When the early settlers established themselves in New Zealand, cultivation was much hindered by the great abundance of *Pteris esculenta*, which had been cherished by the natives for centuries as an article of food; it was found, however, that by sending cattle to browse upon the young leaves, the plants were trodden down and quickly perished, being succeeded by rich, wholesome grass. If mown down two or three times in the course of a summer, while the fronds are still young, the fern will soon be eradicated. If, on the other hand, it is desired to establish the Bracken in any locality, the rhizome should be taken up in lengths of two feet, or thereabouts, care being taken not to injure the roots, as the fibres are brittle and readily break off; the beginning of October is a good time for performing the operation.

Although so common a plant, *Pteris aquilina* has not an extensive popular nomenclature. It is most generally known as Brake or Bracken—the latter name varying to Breckon or Braikin—although, as we have already seen, this is sometimes used for ferns in general. Dr. Prior derives the word Brakes from the German word *brache* or *brach-feld*, uncultivated land, a term which was used "to replace the mediæval Latin *fractitius* or *ruptitius* ager, land that is breakable, or again open to tillage after a term of years, land that is not preserved as forest. The fern so called is named from its place of growth in the same way as whin, heath, bent, and brier." Bracken he considers a word introduced from Scandinavia, and identical with the Swedish *bräken*, which Rietz derives from *bräcka* (break). It is called the Eagle Brake, which was an Anglo-Saxon form of the name; and Mr. Cockayne quotes "wylde brake" as occurring in a MS. of the 12th century. This may be the plant intended in the



Anglo-Saxon "Herbarium Apuleii," under the name of fern: "For wounds, take a root of this wort, which is named filex, and by another name fern, pounded, lay it to the wound"; and again, in the "Leech-book" (i. 23), also edited by Mr. Cockayne: "For thigh ache, smoke the thighs thoroughly with fern."

The Bracken is called the Eagle Fern in books, with reference to the markings in the rhizome already described, and the Scotch name Ern-fern has a similar meaning, ern being a Scotch word for eagle. In Norfolk it is sometimes called the Oak Fern, again in allusion to the form which the markings of the rhizome have been supposed to exhibit. We have already pointed out the meaning of the name Female Fern as applied to the Bracken. Jamieson gives Shady-bracken as one of its Scotch titles. In Sussex it is sometimes called Adder-spit. It is known in French as *fougère porte-aigle*, *grande fougère femelle*, and *fougère à cerises*.

### PTERIS ARGUTA, *Ait.*

We have here another fine species, which only reaches the south-western shores of Europe, and is unknown in the rest of the continent. *P. arguta* (which is sometimes called *P. palustris*, Poir.) is a fern with a creeping rhizome, covered at the end with copious, very narrow, long, shining, dark-brown paleæ. The stipites are stout, hard, and erect; quite smooth, cylindrical, without any scales or hairs, and of a bright orange-brown: they attain a length of one or two feet, and support a frond of about the same or rather greater length. This is of a thin almost membranous texture, and has a somewhat drooping habit; its outline is ovate, narrower or broader in different specimens, and very acute. The pinnæ are large, not very numerous, rather distant, nearly opposite, and directed forward; their usual form is lanceolate-oblong, drawn out and tapering at the point; they are sessile on the main rachis, or very nearly so, the lowest pair being sometimes shortly stalked. These pinnæ are simply pinnate, or perhaps we should rather say pinnatisect, the pinnules or segments being very broad-based, oblong-lanceolate, somewhat curved forward or falcate, acute at the end, and finely but sharply toothed along the edge; they are decurrent at the base, as is specially observable in the lowest one next the rachis, which usually runs down the latter for a short distance. The colour is a bright, clear, dark-green, the surface is quite smooth, and the lateral veins are simply forked, a branch running into each tooth. The lowest pinnæ are not unfrequently further divided, the pinnules, on the lower side especially, being large and long, and divided into tertiary divisions of similar form to those above described. The sori are placed on the edge of the segments, in a line of variable length, and never occupying the whole of the margin; it is usually the lower part that is soriferous, the upper portion being barren; at the parts where there is fructification the marginal teeth are absent. The sporangia are very numerous, and nearly covered by the membranous, greyish-brown false indusium, which has no teeth or hairs at the edge; there is no true inferior indusium, but numerous minute thread-like bodies mixed with the sporangia are supposed to represent it.

The head-quarters of this beautiful species are in the Atlantic Islands, especially Madeira, where it is abundant in wet shady ravines from nearly the sea-level up to 3,000 feet; in the Azorean Islands it is also common, and it grows in Teneriffe. As above remarked, the only certainly known locality on the Continent of Europe is in Portugal, where, in the Serra de Cintra, near Lisbon, it has long been known to occur rarely. The late Dr. Welwitsch collected specimens in this locality in 1848, but it has not been met with in other parts of the Spanish



Peninsula. We have met with a record of "Corfu" for this Fern, but do not know on whose authority it rests. Beyond Europe, it grows in Arabia and in many parts of tropical Africa (Abyssinia, Angola), and also reaching the Cape of Good Hope (*P. flabellata*, Thunb.). What is probably the same species also occurs in the West Indies, so that, though so rare in Europe, this species occurs over a wide extent of the globe.

*P. arguta* has long been met with in our greenhouses; it was introduced to cultivation in England in 1778, by Francis Masson.

#### PTERIS LONGIFOLIA, Linn.

In this species the caudex is short and tufted, and the fronds come off in close proximity; its extremity is covered with elongated, narrow, pale-brown scales, which also extend up the stipites of the fronds, though in no great number. The stipes is rather short, sometimes very remarkably so, and is channelled along its upper surface and sides; when young it is covered with narrow pale-coloured scales, but afterwards becomes nearly smooth. The whole length of the fronds varies considerably, but in European specimens does not much exceed two feet; their form is lanceolate, much tapered towards the base, and they are simply pinnate. The pinnæ are remarkably long and narrow, quite undivided, usually opposite or nearly so, sessile, and placed at a distance from one another; they are four to six inches long and much drawn out, their form being linear, but widest at the base, which is abruptly truncate or frequently cordate or eared; the frond ends in a single terminal pinna, which is usually longer than the rest. The veins are closely placed and free, terminating at the margin of the pinnæ, which is finely but sharply senate, with minute hard teeth. The sori are marginal, copiously produced, extending along nearly the whole border of the pinnæ, and covered with the quite entire reflexed false indusium.

This is a southern Fern, and its European localities are all in the Mediterranean basin. There are several in the south of Spain, as near Malaga and Granada, but it does not grow in other parts of Spain or in Portugal. In Italy, *P. longifolia* is found in Calabria and near Naples, and in Sicily there are several well-known localities. An outlying station is the island of Ischia, off the Neapolitan coast, where the Fern grows on the hot tufaceous rock of an extinct volcano, from which place there are specimens in the British Museum herbarium. Passing eastward, we find it in Dalmatia, Zante, and the Morea, and it further extends in this direction, out of Europe, to Lycia and Syria. Returning along the south shore of the Mediterranean, Egypt and Algeria produce the plant, and it is also found in the Canary Islands and the Cape Verdes, but does not reach the Azores. It grows in shady wet places on rocks and old walls.

Beyond these regions, however, *P. longifolia* is found in most of the hot countries of the world. It is abundant in tropical Asia, as throughout peninsular India (ascending to 4,000 feet in the Himalayas), Java, the Malay Archipelago, &c., and reaches to the Pacific Islands. In tropical Africa it has a wide distribution also, and grows in Madagascar and in Mauritius. It is less common in America, though abundant in the West Indian Islands; Mexico and Venezuela appear to be the only localities on the continent.

Out of the very numerous names—about twenty in number—which have been bestowed upon this species, we may mention two by which it is frequently known: *P. ensifolia*, Sw. and *P. vittata*, Linn. It is very frequently met with in cultivation, and is most easily grown;



indeed, its spores develop in such abundance, and so rapidly, that the plant sometimes becomes a positive nuisance in hothouses. It was introduced to English gardens in 1770, having been brought from the West Indies by Mr. James Gordon. There is an admirable folio plate of the European plant in a little known work by MM. Chaubard and Bory de St. Vincent, published in 1838, and entitled, "Nouvelle Flora du Péloponnèse et des Cyclades."

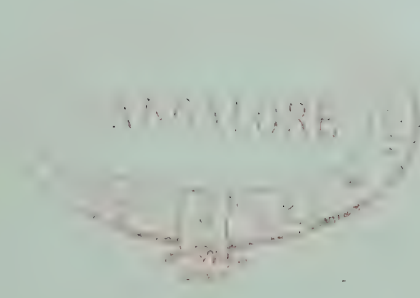
### PTERIS CRETICA, Linn.

This is well known in cultivation, and is not a very variable plant. Its caudex is very short, so that the fronds are closely set and have a tufted appearance, and is sparingly clothed with small dark brown paleæ. The fronds are of no great size, varying from one to two feet, of which the stipes occupies about half; this is stiff, erect, and perfectly smooth, somewhat three-sided above, but rather dilated at the base, where it is darker in colour. The frond itself is wider than in the last species, *P. longifolia*, its outline being distinctly ovate, or even broader than long, abrupt at the base, and more or less acuminate at the apex. It is pinnate, but not so simply as the last, the lowest pair or pairs being again divided. In texture this Fern is thick and firm, and in colour a glossy bright green. The pinnæ are few in number, being, indeed, sometimes reduced to three—that is, one pair and the terminal one; but more often there are six to ten pairs; in form they are not unlike those of the last species, being distantly placed on the rachis, sessile, and very long, and tapering to a slender, much attenuated point; their base is also tapering, not truncate, and sometimes even decurrent down the rachis. As above noted, the lower pinnæ are compound, but they are so in a somewhat peculiar manner, appearing rather as if two or three pinnæ had coalesced; the separate segment or segments being usually nearly as large as the primary pinna, and similar to it in form and venation; this latter is free, the veinlets being branched close to their base. Though it can be scarcely said that the fertile and barren fronds of this species are always distinct, yet there are frequently fronds which produce no fructification. These possess broader pinnæ, more lanceolate in shape and shorter. In all the fronds the margin of the pinnæ is set with very sharp spinous teeth, especially developed towards the ends of the pinnæ, but where the margins are occupied by sori these teeth are not found. The line of sori is broad and continuous along the margin of the fertile pinnæ for about three-quarters of their length, the upper part only being without them. The reflexed false indusium is much narrower than in the last species, and covers but little of the sori; there is no rudiment of a true indusium.

Like the last species, this is a South European Fern, and is rather widely spread through the Mediterranean region. We have seen specimens from Corsica, where it seems abundant; but it does not appear to reach westwards to the Spanish Peninsula, nor does it grow in Southern France, though there is a locality at Mentone, close to the frontier of that country. In several parts of North Italy it is met with, the most northern locality being near Como, and in South Italy and Sicily it is more frequent. Sardinia and Crete (whence it takes its name) also produce this Fern, which extends its range to the Caucasus, Persia, and Arabia. It has been collected, too, further north, in the Ural district near Baku.

In Africa, *P. cretica* grows in Abyssinia and in the Cape Colony, and has been found in Bourbon. It is a frequent Fern in India, extending up to 6,000 feet in the Himalayas, and occurs in the Malayan Islands frequently, and in the Pacific ones also. It also reaches the southern part of North America and Mexico, and in South America it is found in Guatemala,









CHEILANTHES

C. FRAGRANS (Hook.)

C. SZOVITZII. (F. & M.)



Entre Rios, &c. Considering its very wide dispersion, it does not present us with much variability. Its sharp spinous teeth are alluded to in several of the synonyms which it possesses: for instance, it is the *P. serraria* of Swartz, a very good name.

Although now so commonly met with, *Pteris cretica* was not introduced to our gardens at a very early period. The exact date of its introduction does not seem to be known, but there is a note attached to some of Mr. John Smith's specimens in the British Museum herbarium, stating that it was in Kew Gardens as early as 1822. Like the species last described, it increases very rapidly; it has grown spontaneously for a long time on the damp walls of the botanical houses at the Jardin des Plantes in Paris, and springs up in similar situations at Kew.

The variety *albo-lineata*, to which we have already alluded, is an extremely elegant plant, well characterised by the whole length of the centre of the frond being more or less irregularly taken up by a white streak, the remainder of the frond being dark green. Although now so frequently met with in cultivation, it is of comparatively recent introduction; it is figured in the "Botanical Magazine" for August, 1860, and is there stated to have been previously unrecorded. The variety is interesting as being one of those which is met with in a wild state, being found in Java and also, more recently, in Brazil. Like the typical form of the species, it increases readily from spores, and preserves its character. It is deservedly in request for bouquets, as it retains its freshness for a long time.



VARIETIES OF PTERIS.



## ADIANTUM: THE MAIDENHAIR FERNS.



WE have now arrived at one of the most beautiful of the genera of European ferns—one which from its graceful habit is deservedly amongst the most popular in cultivation, and which is, therefore, very familiar even to those least acquainted with ferns in general. The head-quarters of the Maidenhair Ferns—of which about eighty or a hundred species are enumerated—is Tropical America; but they are widely spread over the tropical and temperate regions of both the Old and New Worlds, some of them being of very extended distribution, as, for instance, our European *A. Capillus-veneris* and also *A. æthiopicum*, of which we shall have occasion to speak more at length further on. Our common Maidenhair may be taken as the type of the genus, the elegantly-divided fronds, and the dark, slender, shining stipes being characteristic of many of the species; but a few of very different habit require a passing notice. Most distinct of these, so far as general appearance goes, are *A. reniforme* and *A. Parishii*, which differ from all the other species in having simple fronds. These are small, densely-tufted plants, the former about six inches high, the latter much shorter, with dark brown stipes and nearly round fronds, which are from two to four inches broad in *A. reniforme* and smaller in *A. Parishii*. The former is a native of Madeira and the Canaries, a form sometimes called *A. asarifolium* occurring in Mauritius and at Natal, while *A. Parishii* is a native of Moulmein and the Malay peninsula. *A. reniforme* was in cultivation in England so long ago as 1699, when it was grown at Oxford by Bobart.

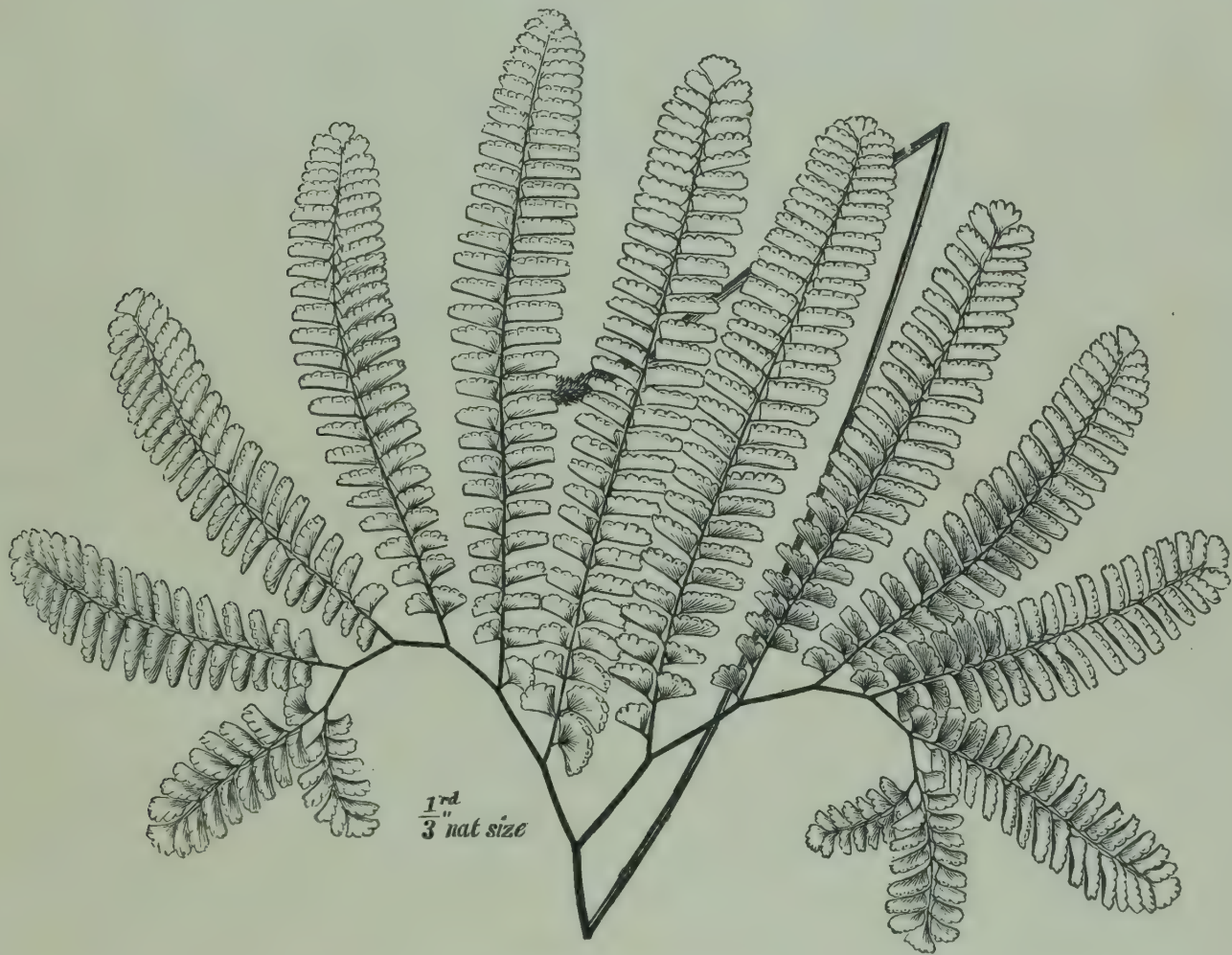
A second well-marked group is that styled in the “Synopsis Filicum” *radicantes*, the plants of which are characterised by having a simply pinnate frond, the rachis of which is often elongated to some distance beyond the segments, and takes root at the apex. Of this group we have two in cultivation, *A. lunulatum* and *A. caudatum*. The former is a plant of wide distribution, extending from Hongkong and the Himalayas to the Polynesian Islands and Tropical Australia, and found in Madagascar and various parts of the African continent, as well as in Tropical America, from Mexico to Brazil; *A. caudatum* being confined to the Old World, where it extends through the Tropics and occurs in the Himalayas and Hongkong.

Yet another type of Maidenhair is that presented by *A. pedatum*, the most graceful of all North American ferns, which occurs also in Japan, Mandschuria, and in North Hindostan, where it ascends to an elevation of nine thousand feet. Specimens from Nootka Sound are in the British Museum Herbarium. In this and allied species we have a distinct stipes, which is dichotomously forked, the spreading gracefully recurved branches bearing on the outer side several slender pinnate divisions. This, as we shall see farther on, is one of the few ferns which have been employed in medicine, although it can hardly be said to manifest properties of great importance. One point connected with it is interesting to English fern-growers—it is the most hardy of all the Adiantums. Mr. E. J. Lowe says it will withstand a degree of cold which would be certain death to our indigenous Maidenhair; and adds that in 1854 he found that plants “lived out of doors with the temperature six degrees below zero of Fahrenheit’s thermometer, whilst near them



the same cold killed all the plants of *A. Capillus-veneris*. The young fronds are delicate, and, coming up early, those first appearing are not unfrequently cut with spring frosts." It has been in cultivation in this country for a long period, having been introduced by the younger Tradescant before 1640. From an old specimen in the British Museum Herbarium, collected in the "Cherokee country" in 1769, we learn that its Indian name is *Outoanaka*, which means "black stalk."

In the section of which our British Maidenhair may be taken as the type, there is one plant which has of late years attracted much attention, and which indeed is at the present time perhaps the most popular form in cultivation. This is the very beautiful *A. Farleyense*,



ADIANTUM PEDATUM.

which Mr. Moore, who first described it, well calls "one of the most graceful species yet known of perhaps the most lovely genus of the pre-eminently lovely family of ferns." It was first exhibited at a show of the Royal Horticultural Society in 1865, and at once attracted great attention. Its origin is a little obscure, and its claims to specific rank are not admitted by the best authorities on ferns, in spite of its extremely distinct appearance. The first example came up among some ferns sent from the West Indies by Mr. T. G. Briggs, of Barbadoes, the name of whose residence in that island (Farley Hill) is commemorated in the specific title of the plant. So far as we are aware, the fern has not been met with in a wild state; and Mr. Moore regards it as a well-marked "sport" of *A. tenerum*, or possibly a hybrid between that species and *A. trapeziforme*. It has, however, since been stated that seedlings of *A. Farleyense* have produced another species,



*A. scutum*, and this, if correct, would show it to be a form of that species. The dense masses and gracefully-pendant habit of the fronds, their large size and bright light green colour (the young ones being at first of a delicate pinkish hue), and the elegantly-fringed pinnules of the sterile fronds, combine to render *A. Farleyense* an object of intense admiration wherever seen.

Another species belonging to this group is *A. fragile*, a native of Jamaica, which has the disagreeable peculiarity (from a herbarium point of view) of shedding all its pinnules when dried. Sir W. J. Hooker says:—"I have received specimens from Jamaica from five different persons of this singular plant, all exhibiting the same unfortunate character of shedding every leaflet in the act of drying: so that the specimens have come home showing the tufted root, a perfect skeleton of wiry stipites (growing in tufts), with the exceedingly slender and equally wiry rachis very much branched, and the pinnules all lying apart from the plant. Not a specimen is fit for the herbarium nor fit for making a drawing."

Besides the above, there are many other very distinct and ornamental species of *Adiantum*, as, for instance, *A. macrophyllum*, a Tropical and Central American species, with long, simply pinnate fronds, which when young are often beautifully tinged with red, and equal-sided serrate pinnæ. Two other species from the same region—*A. digitatum* and *A. Feei*—are of climbing habit, having stems several feet in length. Indeed, whether we consider the beauty or the variety of form presented by the plants belonging to this genus, we shall find it entitled to an equally high position in the order to which it belongs.

The genus *Adiantum* is botanically distinguished by the peculiar position of the sori. In *Pteris*, as we have already seen, the sori are placed upon the margins of the pinnæ and covered over by the indusium; but in *Adiantum* the opposite is the case, inasmuch as the sori are attached, not to the frond, but to the under surface of the indusium, which consists, as Mr. Moore has said, "as it were of a portion of the apex of the lobe, reflexed and changed in texture into a thin, bleached, veiny membrane, the veins being the receptacles," and are, therefore, as the same author puts it, "turned upside down on to the surface of the frond." By this peculiarity plants of this genus may be at once distinguished from all other ferns. The free venation of the *Adiantums* is also noteworthy and characteristic; with the exception of four species, which, on account of their netted veins, have been placed by some authors in a separate genus (*Hewardia*), all the species have the veins quite free and separate. The black shining stipes is, as has already been said, also characteristic of the genus.

#### TRUE MAIDENHAIR: ADIANTUM CAPILLUS-VENERIS, Linn.

It is hardly necessary to describe at very great length so well-known and popular a fern as this; for, although several species of *Adiantum* are somewhat closely related, there is no European fern with which it can be confounded. The black or dark chestnut, shining, slender stems, entirely devoid of scales or hairs, with their thread-like branchlets, and the more or less fan-shaped pinnules, at once distinguish it from any other European species. It is a plant of perennial duration; the fronds which are persistent, are produced annually from a slowly creeping caudex, which is black and scaly, about as thick as a quill. These fronds droop considerably, are of a bright, cheerful green colour, and of membranous texture, are irregular in shape, and vary a good deal in size and in ramification; when first



produced, in spring, three or five pinnæ only appear, which shortly become divided into pinnules. The mature fronds themselves vary from four or six inches to a foot and a half, or even more, in length (including the stipes), their usual length being about midway between these extremes; their general outline is more or less ovate, or sometimes somewhat triangular. The pinnæ are alternate, as are also the pinnules; the latter vary a good deal in form, those on the fertile fronds being fanshaped or wedgeshaped below, and divided above into a number of lobes, the terminal portion of which is reflexed and changed into a thin bleached membrane, upon the inner surface of which the sori are borne in clusters. In the barren fronds, which are less frequent,



PINNULES OF THREE DIFFERENT PLANTS OF ADIANTUM CAPILLUS-VENERIS, SHOWING THE RANGE OF FORM. 1 AND 3 FERTILE, 2 BARREN.

the terminal lobes are not thus reflexed, but are carried onward, the outline of the pinnule then presenting a sharply cut or serrated, instead of a rounded, appearance. The pinnules are beautifully lined in a delicate fan-like manner, with numerous closely-placed forked veins radiating from the base, the veins remaining distinct from each other, and not forming a network. Mr. Newman says that when grown in a Wardian case the lobes of the pinnules sometimes become viviparous at the extremities, the spores actually vegetating while *in situ*, and the young plants taking root, like parasites, in the substance of the old one.

In Europe the Maidenhair is dispersed over the central and southern portions, being most abundant in the Mediterranean region. It is frequently met with in most parts of Spain and Portugal, on rocks and in caverns, and about wells and fountains, ascending in the Sierra Nevada to about four thousand feet. France, Italy, Switzerland, Hungary, Germany, Dalmatia, Belgium, and Holland all produce it; it abounds in Sicily, and it is also found in Turkey and Greece, in great quantity. One of its best known and most classical localities in Italy is that of the Fountain of Egeria, where it occurs in great beauty and luxuriance.



ADIANTUM CAPILLUS-VENERIS, SEEDLING.

"The mosses of the fountain still are sprinkled  
With thine Elysian water-drops; the face  
Of the cave-guarded spring, with years unwrinkled,  
Reflects the meek-eyed genius of the place,  
Whose green, wild margin now no more erase  
Art's works; nor must the delicate waters sleep  
'Prisoned in marble; bubbling from the base  
Of the cleft statue, with a gentle leap  
The rill runs o'er; and, round, ferns, flowers, and ivy creep  
Fantastically tangled."

Bory and Chaubard, in their "Flore de la Péloponnèse," state that in that region under favourable circumstances its fronds attain the length of two feet or more, and are



proportionately large in all their parts. These authors refer also to a very remarkable variety collected by them in the fountain of Callirhoe, at Athens. This plant, although fully developed, was not more than two or three inches in height; the pinnules were small and hardly emarginate; and the variety greatly resembled *A. æthiopicum* in general appearance. Its extra-European distribution extends throughout the temperate and subtropical regions of the globe, especially in the northern hemisphere, it being less abundant within the Tropics. In Asia, we find the Maidenhair occurring in Siberia and in the Caucasus, in Arabia and Syria (Jerusalem, Sinai, and Galilee), in China and Japan, and throughout the damp hilly districts of India. It is very abundant in the African islands, occurring in Madagascar and Mauritius, the Azores, the Cape de Verde Islands, in Madeira and the Canaries; in the two last it is exceedingly common, growing wherever water trickles through the rocks, and affecting especially the vertical surface of walls, which are sometimes entirely covered with it. In the Canaries large porous vases, for the purpose of cooling and filtering the water supplied by the aqueducts, are almost indispensable to every household; and these vases are often entirely covered with Maidenhair, presenting a very beautiful appearance. So readily is the fern established in this situation that the inhabitants, wishing to encourage its growth upon new vases, find it sufficient to rub them over with the mature spore-bearing fronds, after which young plants are not long in making their appearance. On the African continent it occurs in Algiers, Abyssinia, and Egypt, and also in South Africa—in Natal and at Algoa Bay. In Australasia the plant is found in Queensland, and also in New Caledonia and the Sandwich Islands. In the New World it occurs in Mexico and other parts of Central America, in Chili, and in the West Indies; and also in the southern United States—Florida, Alabama, and westward.

In the British Islands, the distribution of the Maidenhair is distinctly of a western type. In England its headquarters are in the counties of Devon and Cornwall, in which it occurs in many localities, affecting low sea caves and the clefts of coast rocks; it was formerly abundant in the neighbourhood of Ilfracombe, but of late years has become very scarce there, and can only be obtained if the collector is sufficiently enthusiastic to allow himself to be let down over the cliffs by a rope. We do not think it advisable to give detailed descriptions of the localities recorded for this beautiful fern, which is already in danger of becoming exterminated, owing to the ravages of collectors, if, indeed, it has not already disappeared from some of its localities. It has also occurred in Dorset, and is recorded for North Somerset, although this is doubtful, as it is said that the leaves of a flowering plant, *Thalictrum saxatile*, have been mistaken for it at Cheddar. On the coast of Glamorganshire, it is, or was, abundant; there is a specimen in the British Museum Herbarium, collected in June, 1773, at Cardiff, from "a cliff called Nine-acre Cliff, half a mile from Porth Kerrig Church, in the face next the sea, where a petrifying water falls down, generally in places not accessible without much difficulty." On some parts of the Glamorganshire coast it grows very luxuriously, forming a green tapestry on the face of the cliff, and sometimes within reach of the spray. It has long been known as growing in the Isle of Man: other English counties have been recorded for it, but its occurrence in them has not been authenticated, and it is stated that in more than one instance young plants of the Bracken have been mistaken for the Maidenhair! It is, apparently, absent from Scotland, although it has been recorded from one or two stations in that country. In Ireland it is very local, occurring chiefly, if not entirely, in the West; the Isle of Arran and the Burren mountains are its oldest and best known localities, it having been recorded from Arran by Lhwyd previous to 1699. It has also occurred in various places of the county Clare, from Connemara, and Sligo; and it is reported to have



been found in a cave near the Giants' Causeway, Antrim. The Maidenhair of Burren and Arran is very luxuriant, and often has the pinnules more deeply cut than in the ordinary form of the species; the figure in "English Botany" (t. 1564) is from an Arran specimen.

In his "Nature-printed Ferns," Mr. T. Moore distinguishes three varieties of the Maidenhair as occurring in the United Kingdom. The first, *ramulosum*, has the main rachis divided two or three times near the top, so that the apex of the frond is formed of a spreading tuft of short pinnate branches. The second, *incisum*, has both the barren and fertile pinnules throughout the frond somewhat regularly split down into long, narrow, wedge-shaped lobes. The third, *rotundatum*, is marked by the outline of the basal pinnules being rounder than usual, with a truncate base; the fronds are narrow, and the pinnæ more spreading. There is a specimen in the British Museum Herbarium, descended from a plant collected at Boscastle, North Cornwall, which is apparently to be referred to the last-named variety; in this the pinnules are broader than long, and the whole aspect is very luxuriant—a circumstance probably owing to cultivation, at any rate in some degree.

On the faith of a statement in the "Synopsis Filicum," we had originally included in a list of European ferns *A. æthiopicum*, Linn., of which a figure will be found on plate 6. There is a specimen in the Kew Herbarium labelled "Spain, G. McLeay, 1860;" and this caused the insertion of the species in the "Synopsis" as a European plant; but it is not included in Willkomm and Lange's "Prodromus Floræ Hispaniæ," and there is thus reason to suppose some mistake in the matter. *A. æthiopicum* is a plant resembling *A. Capillus-veneris* in its wide extra-European distribution, and also resembling it very strongly in general appearance. Sir W. J. Hooker, however, says it is "truly and constantly distinct: firstly, in the more orbicular and less sharply and gradually attenuated base of the pinnules; and, secondly, in the fructification, the sori here being placed in the sinus of a notch in the lobe, and the involucre quite broad, lunate, or veniform, not occupying the whole apex of the lobe." As has been mentioned above, with regard to the plant collected by Chaubard and Bory at Athens, *A. Capillus-veneris* sometimes approaches *A. æthiopicum* very closely; but the two species are usually considered distinct by the best authorities on the subject.

The Maidenhair has in France acquired some little importance from its employment in the manufacture of a syrup known, from the Latin name of the plant, as *capillaire*, which has been supposed to possess pectoral qualities, and, when diluted with water, forms a very refreshing drink. It was formerly prepared by adding sugar and orange-flower water to an infusion of the fern; but as the Maidenhair was found to serve no essential purpose, it is frequently omitted and, according to Pereira, the syrup sold in the shops under the name of *capillaire* is nothing but clarified syrup flavoured with orange-flower water. The Prussian and Hamburgh Pharmacopœias authorise this substitution by giving formulæ for a *sympus floræ aurantii*, to be used "in loco sympi capillorum veneris." A recipe for making *capillaire* runs thus: Take of Maidenhair leaves five ounces; liquorice-root, peeled and sliced, two ounces; boiling water, five pints: let them remain for six hours; strain, and then add thirteen pounds of the finest loaf sugar, and one pint of orange-flower water. The simple infusion of the plant in water, sweetened in the manner of tea, has been recommended for the same purposes as the syrup.

From some of the earlier Irish floras it would appear that the collecting of Maidenhair for the preparation of *capillaire* was at one time very extensively carried on. Thus Keogh, in his "Botanologia Universalis Hibernica" (1735), says of it: "The best in this kingdom is brought from the rocky mountains of Burren, in the county of Clare, where it grows plentifully; from thence it is brought in sacks to Dublin, and sold there:" and he goes on to narrate its virtues,



which are both numerous and varied: "it is pulmonic, lithontriptic . . . wonderfully helps those afflicted with asthmas, shortness of breath, and coughs . . . It is also good against jaundice, dropsy, and the bitings of mad dogs." It is stated that the fern was exported in large quantities to London from Ireland in the middle of the last century: and it is on record that two hogsheads were so sent by one person from the Isles of Arran, where the fern is very abundant in the deep clefts of the rocks, being known to the natives as *dubh-chosach*, or "black-footed."

In North America the beautiful *Adiantum pedatum*, to which reference has already been made, is employed more extensively in a similar manner, and is often substituted for the true Maidenhair. Its chief use is as a refrigerant drink in febrile diseases and in erysipelas; and its expectorant and subastringent properties render it also useful in coughs and asthma. The plant is highly valued by some American practitioners, and its properties are at any rate of sufficient importance to demand further investigation. It is said that its substitution in France for the true Maidenhair arose from the circumstance that the French Canadians sent over large quantities to France as a package for goods: its similarity to the true Maidenhair arrested attention, and it was ultimately used instead of it. According to Kalm, *A. pedatum* has been employed from time immemorial by the North American Indians in cases of difficulty of breathing. In some parts of Brazil another species, *A. dolabriforme*, bearing the vernacular name of *Venca*, is used in pectoral complaints. The fronds of *A. melanocaulon* are believed to be tonic in India.

The "vertues" of Maidenhair, according to old writers, were both numerous and varied. Many are set forward in Langham's "Guide of Health"—a black-letter seventeenth-century volume—and of these the following are samples:—"Seethe it in wine, and drinke it for shortnesse and straitnesse of breath, the hard and uneasie cough, and to cause easie spitting. . . . Bitings of mad dogges and venomous beasts, stampe it greene and apply it. It restoreth haire, dispatcheth the strume or swellings in children's throats. . . . Headach, weare a garland of it, or a quilted cap of it about the head. . . . Given in meat to quails, it maketh them to fight well:" and so on. The property last referred to is similar to one mentioned by Pliny as belonging to his "adiantum," which, as we have already said, is perhaps an altogether different plant. He says: "It is a general belief that partridges and cocks are rendered more pugnacious if this plant is mixed with their food." Langham's list of "vertues," however, pales before that set forward by one Peter Formius in a small French treatise devoted to the plant, which was published in 1644. Our illustrious countryman, John Ray, condenses his account in the "Historia Plantarum," and remarks that, if all these virtues existed in the Maidenhair, it might indeed be looked upon as a panacea for every disease, being in itself sufficient to cure any disorder, no matter of what kind, and regardless of the part of the body affected. He, however, proposes a drink to be made from it, which he suggests might be efficaciously employed in fevers and similar cases. For this about three handfuls of the recently collected leaves should be placed in warm or gently boiling water, and allowed to remain for the space of one night. It is said that a strong decoction will act as an emetic. Ray also tells us that in the neighbourhood of Narbonne the growth of Maidenhair about the wells and fountains is looked upon as a sure sign of the purity and sweetness of the water yielded by them. According to Pereira, other ferns, besides those already named, have been employed under the name of Maidenhair, especially the Black Maidenhair Spleenwort (*Asplenium Adiantum-nigrum*), the Wall Rue (*A. Ruta-muraria*), the Scaly Spleenwort (*Ceterach officinarum*), and the Hart's-tongue (*Scolopendrium vulgare*).

The name *Adiantum* is derived, as Pliny tells us, from the Greek *ἀ* (*not*) and *διαίω* (*to wet*), because, he says, "when sprinkled with water or dipped in it, it has all the appearance of having been dried, so great is its antipathy to moisture." His description, however, is hardly appropriate









CRYPTOGRAMMA CRISPA. (R.Br.)

(a) PORTION OF BARREN FROND. (b) TERMINAL SEGMENT OF FERTILE FROND



to our Maidenhair, although he speaks of a use of the plant which accords well with that to which our species is supposed to owe its name. He says that a decoction of it was made in wine with parsley-seed for the purpose of imparting colour to the hair, large quantities of oil being added if it is desired to make the hair thick and curly as well; and he also attributes to it the property of preventing the hair from coming off. The black, hair-like stalks of our British plant probably suggested its name *Capillus-veneris*, as well as its English equivalent; and its supposed efficacy in restoring the hair is likely enough to have been suggested, on the "doctrine of signatures," by the same circumstance. Coles, writing in 1657, says: "The lye wherein Maidenhaire is sodden or infused is good to bathe the head, and make the haire come thicker in those places which are more thin and bare." The subject of our present description is here referred to; but various other plants have been called Maidenhair from time to time, among them the pretty yellow Bog Asphodel (*Narthecium ossifragum*), of which Johnson writes in 1636: "In Lancashire [it] is used by women to die their haire of a yellowish colour, and therefore by them it is termed Maiden-haire;" while the pretty Lady's Bedstraw (*Galium verum*) was also called Maidenhair—according to Coles, "from the fineness of the leaves."

Gerard seems to look upon the Maidenhair fern as one of the plants formerly named in commemoration of the Blessed Virgin, and says "it may be called Our Lady's Hair;" but the Latin name suggests that it was rather dedicated to Venus. As we shall see when we come to speak of *Asplenium Trichomanes*, that species has also been termed Maidenhair; and it is with this that Mrs. Chanter (in "Ferny Combes") associates a German legend which she does not definitely localise, and which has rather a modern sound. She says: "A lady was keeping tryst with her lover, when he was suddenly, after the fashion of Germany in those days, transformed into a wolf. The lady fled before him, and in her haste fell over a precipice, her black hair tangling in the bushes as she descended. On the spot where she fell a clear spring welled up, and round about her hair took root. The well is called 'the Wolf's Spring,' and the little custodian of the glen, after telling you the story, hands you a bunch of the 'Maiden's Hair.'"



ADIANTUM CUNEATUM.

Reference has already been made to *Adiantum cuneatum*, and it may be well to say a word or two more about it, inasmuch as it is probably this species which is considered by most people as being the true Maidenhair. It is certainly the plant usually grown in greenhouses under that name, and this is natural enough, as it is very much more easy to grow, and its fronds last longer when cut, so that it is more suitable for use in bouquets and for other decorative purposes. Notwithstanding its general cultivation at the present day, it is not an old inhabitant of our stoves, having been first introduced to this country in a living state in 1841, when plants were sent from the Botanic Gardens at Berlin to the Royal Gardens at Kew. The fronds are about a foot (sometimes more) in length, gracefully spreading, and ovate in form; they are very numerous, rising from a tufted rhizome, forming in large plants a dense mass;



the pinnules are smaller than those of *A. capillus-veneris*, and more deeply cut, resembling rather those of *A. ethiopicum*. The fern, indeed, is closely allied to that species, but the pinnules are always wedge-shaped and more deeply lobed. The footstalks are black and thread-like, as in the true Maidenhair; the green of the fern is of a different shade, and the general appearance of the plant is more slender and lax, owing to the smaller size of the pinnules. Our figure shows the appearance of a portion of a frond.

*A. cuneatum* is very easily cultivated; indeed, when once established it will propagate itself by self-sown spores, which will readily spring up in neighbouring pots. But care must be taken to preserve the fronds from the drip of water, as, owing to their extreme delicacy, they will not stand this; a certain amount of moisture, plenty of room, and thorough drainage are essential to its successful cultivation. The species is a native of various parts of Brazil; other species of the genus from different regions are sometimes called *A. cuneatum*, but incorrectly.



ADIANTUM CAPILLUS-VENERIS.

a. Pinnule enlarged.



## CHEILANTHES.



WE have here a genus of ferns comprising about sixty or seventy species, for the most part natives of dry rocky places in tropical regions, but extending into temperate countries, three species being European and four or more natives of the United States. They are for the most part small ferns, but present a very considerable variation in size and form; the European representatives of the genus are, as we shall see, small plants, but many have fronds a foot or a foot and a half in length. The genus is characterised by having the sporangia borne on the thickened ends of free veinlets, bearing small roundish sori close to the margin of the frond: they are covered by a usually whitish and membranous indusium, which is formed of the reflexed margin of the frond. It is to this peculiarity that the name *Cheilanthes* (which is formed of two Greek words—*χείλος*, a lip, and *ἄνθος*, a flower) alludes; and the name Lip-fern is sometimes given as an English equivalent for the genus. The more or less compound fronds are often densely hairy or chaffy, with dark glossy stipites; though to this rule there are exceptions—as, for instance, in *C. multifida*, a native of Africa and Java, the fronds of which are nearly smooth, and triangular or somewhat deltoid in outline. The genus can hardly be considered well defined; Sir W. J. Hooker says, “Vain is the attempt to form any definite character which shall decide its proper limits.” It is undoubtedly very near *Pteris*, scarcely differing from it in the greater distinctness of the sori.

One of the most popular species is *C. argentea*, which is often met with in cultivation. Its specific name refers to the appearance of the under side of the frond, which is covered with a white flour-like powder, as is the case with some species of *Gymnogramma*; the upper surface is of a bright dark green. *C. farinosa* is another species which is similarly silvered beneath; the two species are closely allied, their most obvious difference being in size and geographical distribution. *C. argentea* usually—although Milde speaks of Mandschurian specimens more than a foot long—has fronds from two to four inches high, and is a native of Siberia, China, Japan, the Malay Peninsula, and Khasia, from which last-named region we have a variety (*chrysophylla*) which is golden, not silvery, beneath. The fronds of *C. farinosa* are from half a foot to a foot and a half in length, and in cultivation have been known to occur as long as two feet; this is of more southern distribution, beginning in the Himalayas and extending throughout tropical India, Malaya, Ceylon, Arabia, and Abyssinia, and found also in Central America, where it ascends, in Mexico, to 8,000 feet. This species varies very much in cultivation, as is shown by Mr. John Smith's very fine range of specimens in the Herbarium of the British Museum. The author just mentioned did not look upon it as really distinct from *C. argentea*, and a note from him attached to a specimen in the Herbarium says: “Stunted, starved plants of *C. farinosa* assume the appearance of *C. argentea*; and I have no doubt that living plants, or plants raised from genuine spores of *C. argentea*, could, under cultivation, be made to assume the appearance of *C. farinosa*. Difference in size appears to me the only specific difference between them—the first being small, not exceeding two to four inches in height, while the second sometimes attains the height of nearly two feet.” *C. argentea* was introduced to cultivation in England in 1823; *C. farinosa* was first grown in this country at the Royal Gardens, Kew, in 1827.



Besides these two well-known plants, many other species of *Cheilanthes* are or have been in cultivation in this country. Mr. E. J. Lowe, in his "Ferns, British and Exotic," figures eighteen species which were then known in English gardens, but two or three of these are referred to other genera by more recent writers. *C. viscosa* is a very pretty species, with deltoid or triangular, finely-cut, bright green, tripinnate fronds; it is an American plant, extending from New Mexico to Venezuela, and has been in cultivation in England since 1841. The specific name refers to a characteristic feature of the fronds, which are covered throughout with sticky glandular hairs, the viscosity of which is so powerful that, as noted by Mr. John Smith on a specimen in the British Museum Herbarium, the plant adheres to the paper without the aid of gum or paste. *C. radiata* is a very pretty plant, resembling an *Adiantum* in habit, and originally placed in that genus by Linnæus; it has long stipites, which are terminated by from five to ten pinnæ, all starting from a common centre like the spokes of a wheel, thus imparting a star-like appearance to the frond. This is a native of tropical America, and was cultivated at Kew in 1827: it is a very variable plant, some specimens not exceeding four inches, while others are as much as three feet in height. *C. pteroides* is a very handsome and distinct species, resembling a *Platyloma* in habit, and also approaching *Pteris*, as is suggested by its specific name. It is an old inhabitant of our greenhouses, having been introduced to the Royal Gardens at Kew from the Cape of Good Hope by Francis Masson in 1775; but is not commonly met with at the present day, although it well deserves attention, being one of the handsomest and finest species of the genus, as well as one of the most distinct. It has a thick, creeping, scaly rhizome, from which rise the large, smooth, tripinnate fronds, these being (including the stipes) from a foot to two feet and a half in length. The brown involucre extend over the whole margin of the pinnæ of the fertile fronds, and the contrast between them and the pale green of the fronds is very striking. It is a native of the Cape, at an elevation of from 1,000 to 3,000 feet, and is also found in Java at the top of Mount Gede. *C. tenuifolia* is a pretty, slenderly-divided species, reminding us of a *Cystopteris* in habit; it is a species of wide distribution, extending over the hilly districts of Eastern India, throughout Eastern Asia and the Malay Archipelago, and being very abundant in most parts of Australia: this was introduced to Kew Gardens in 1824. *C. Matthewsii*, a Peruvian species, is remarkable for its long, narrow, linear-lanceolate fronds; *C. micropteris*, a native of tropical America, has them similar in shape, but much smaller, seldom exceeding three inches in length. *C. speciosissima* is, as its name implies, a very beautiful species, a native of Central America, which ascends to 12,000 feet on the Peak of Orizaba, Mexico. The fronds are sometimes two feet or more in length; the rachis is covered throughout with brown, chaffy scales or hairs, and the general aspect at first sight reminds us of an *Aspidium* rather than a *Cheilanthes*.

#### CHEILANTHES FRAGRANS, Hook.

This pretty little fern is familiar to travellers in the Mediterranean region, being a general favourite on account of its delicately fragrant fronds. The fern tribe is not at all remarkable for fragrance, although many ferns have a peculiar odour which is by no means unpleasant; but here and there we come across species with a well-marked and distinct scent. Among our British ferns, for example, we have *Aspidium montanum*, with a pleasant smell of new-mown hay, which is more strongly developed in *A. æmulum*; while *A. fragrans*, a native of the Caucasus, Siberia, and Northern Asia, smells strongly of raspberries, the odour remaining even in the dried fronds, and becoming very obvious when these are soaked in water. A tropical









ADIANTHUM SPECIOSUM

2-1/2 in. long - 1/2 in. wide - 1/2 in. thick - 1/2 in. deep - 1/2 in. high - 1/2 in. long - 1/2 in. wide - 1/2 in. thick - 1/2 in. deep - 1/2 in. high



and Central American fern, *Anemia tomentosa*, has an odour like that of myrrh; *Mohria thurifraga*, a Cape species, smells of benzoin; the bruised fronds of *Angiopteris evecta* are used in the Pacific Islands for imparting an agreeable scent to cocoa-nut oil; while in North America a *Dicksonia* (*D. punctilobula*) is sometimes called the Sweet-scented Fern, on account of the pleasant fragrance of its fronds. It is perhaps hardly necessary to say that the odour in these cases is due to the presence of a large number of very small glands, more especially on the under surface of the frond: when the plant is gathered these are crushed, and the odour is then given out. The fern we are now describing, *Cheilanthes fragrans*, retains its pleasant scent when dried; it resembles that of violets, or perhaps more strictly of violet-powder, there being a faint but perceptible starchy smell mingled with the perfume.

*Cheilanthes fragrans* (which is also known as *C. odora*) is a small fern of tufted habit; the stipes is short (from an inch to three inches in length), firm, and wiry, of a dark shining brown, and covered more or less densely with reddish-brown, linear, hair-like scales: these scales soon fall or are easily rubbed off, and the stipes has then a smooth appearance. The bipinnate fronds are usually about two inches long (sometimes, however, exceeding three inches), and about an inch broad in the lower portion, tapering gradually to the apex; the pinnae are opposite, the lower broadly ovate and distant, the upper ones narrower and closer together; the upper surface is of darkish green, the lower is paler; the sori on the fertile fronds are singly or more numerous on the margins of the pinnae, the indusium being at first pale or whitish, and becoming brown, the margin being toothed or crenate. The species is, however, very variable, not only in size, but also in the division of the fronds and their hairiness. The above description will apply to the usual European form of the plant. Milde distinguishes six forms, three of which are found in Europe. The most frequent of these is that already described, in which the indusium is continuous and ciliate. A second form has an interrupted indusium, which, as in the typical state of the fern, is "abruptly attenuate;" this occurs on Mount Vesuvius and in Sardinia. A third form has also an interrupted indusium, but this is herbaceous, not attenuated; it is a native of Spain. These two forms show by their characters that the distinctions between true *C. fragrans* and the plant which has been described as distinct under the name *C. maderensis*, are insufficient for specific purposes.

As we have already said, *C. fragrans* is one of the most characteristic ferns of the Mediterranean region, extending to the islands, and seldom found very far from the coast. It occurs in Central France, Dalmatia, and Piedmont, extending as far north as Switzerland; in the Eastern Pyrenees and in the south of Spain, on the rock of Gibraltar and in Portugal; and in many parts of Turkey and Greece. Its extra-European distribution is not very extended: it is found in Algeria and Morocco, and is abundant in the Canaries and Madeira, from which last-named island it was introduced to cultivation in England by Francis Masson in 1778. The Madeiran plant has been described as a distinct species by some authors, under the name of *C. maderensis*; but the characters by which it was proposed to distinguish it are neither important nor permanent. In Asia it occurs in the North-western Himalayas, at an elevation of 5,000 feet, as also in Afghanistan, Beloochistan, and Syria; at Jerusalem, and in Lycia and Cilicia. If the authors of the "Synopsis Filicum" are correct in identifying with this species *C. andina*, Hook., a native of the Peruvian Andes, the range of *C. fragrans* must be considerably extended, as it is not usually regarded as a plant of the New World.

*C. fragrans* is an easy plant to grow, and does well either in a cool fern-house or in a Wardian case. Like the other species of the genus, it should be potted in fibrous peat with sand mixed with small pieces of sandstone, care being taken to elevate the crown of the root



above the rim of the pot in which it is planted. It well deserves to be more generally cultivated than is at present the case; as, although many ferns are more strikingly graceful, and others have a more distinct character, it is in itself a pleasing object, and the fragrance of the fronds renders it a well-marked and interesting species.

### CHEILANTHES HISPANICA, *Mett.*

This is a very rare fern—so rare, indeed, that it is but seldom represented, even in large herbaria—and hence our description of it must be borrowed from authors who have been more fortunate than ourselves in this respect. It is interesting as being one of the very few species which are exclusively European (a list—nine in number—of those of which the geographical distribution is thus limited will be found in our introduction, p. xiv.), and its range in Europe is far from extensive. It was originally discovered in Spain, in the province of Estremadura, by Schousboe, in 1798, and to this its specific name is due: since then it has been found on rocks on the banks of the river Mondego, near Coimbra, in Portugal, by the late Dr. Welwitsch; and Milde refers to it, without any doubt, a fern found near Messina by Tinco, which was described by Todaro in 1866, and named by him *C. Tinæi*, in compliment to its discoverer.

*C. Hispanica* much resembles *C. fragrans* in habit, but is readily distinguished by the distinctly deltoid outline of the twice or thrice pinnate fronds. The smooth-tufted, wiry stems are of a dark chestnut-brown hue, and shining; from two to three inches in length, and with a dense tuft of slender wiry hairs at the base, which are similar to the stem in colour. The fronds are of a coriaceous texture, from an inch to an inch and a half long, and about half as broad; they are green and smooth above, but on their under side are densely clothed with jointed, glandular, cinnamon-coloured hairs: the pinnæ are in opposite pairs, the lowest being the largest; these are oblong, or again branched on the lower side. The sori on the fertile fronds are very numerous, covering almost the whole of the under surface.

### CHEILANTHES SZOVITSII, *Fisch. & Meyer.*

Although not so uncommon as the preceding, this fern is by no means frequently met with; in Europe, indeed, its distribution is very limited, as it only occurs in Italy and Dalmatia; but in the East and in Asia it appears to be more frequent, as it has been found in Lycia, the Caucasus, and Mount Taurus, and also in Algeria. It has also been brought from Beloochistan and Tibet, ascending in the last-named district to seven or eight thousand feet. It was first described in 1838, and named in honour of Szovitz, who first brought it from the province of Karabagh, in Asia.

This is an exceedingly beautiful species, and one which is at once readily distinguished—"primo viso," as Milde has it—from *C. fragrans* by the ferruginous wool with which the fronds are covered below. It is closely allied to *C. lanuginosa*, a North American species, from which indeed it only differs in having distinct scales mixed with the woolly clothing of the stipes and rachis.

The fronds spring from a tufted roundish caudex, the crown of which is densely scaly. The stipes, which is about as long as the frond (the latter being from three to four, or even six inches in length, and about a third of that size in breadth), is wiry and somewhat shining, of a blackish purple hue, clothed, like the rachis, with spreading woolly hairs, with which slender scales are intermingled; the scales are scarcely more conspicuous than the hairs, but larger



and subulate (or awl-shaped), and these are very characteristic of the species. The pinnate fronds are narrow-oblong, quite smooth on the upper surface, but densely covered below with a thick coat of a brown woolly covering; the nearly sessile pinnæ are in opposite pairs, the lowest being the smallest, and almost deltoid in shape. The pinnules are set closely together, "cut down to the rachis below into small roundish beaded segments;" the divisions are again divided into ovate ultimate divisions, the margins of which are turned over so as to cover the numerous marginal sori with a spurious indusium, fringed with light-brown hairs. Although so densely clothed with light-brown wool below, the fronds are nearly smooth above, their green hue standing out with great distinctness against the brown marginal fringe which is afforded by the long hairs of the under-surface. One of its names, *C. fimbriata*, no doubt refers to this fringed appearance. Sir W. J. Hooker describes a variety ( $\beta$ . *Stocksii*) from Scinde and Afghanistan, in which the woolly covering is exceedingly dense and tawny, and "so copious and spreading as at first sight apparently to invest the whole frond."



CHEILANTHES ARGENTEA.



## THE PARSLEY FERN.

CRYPTOGRAMME CRISPA, Br.



WE have here a fern which is the only species of the genus in which it is placed, and which may thus be supposed to stand out from its allies with especial distinctness. Genera, arbitrarily defined by naturalists for purposes of classification, are of course based upon certain resemblances or differences between plants or other natural objects, and their recognised extent is largely regulated by the views of different scientific men. As is the case with species in a yet more marked degree, what one man recognises as a distinct type, and then calls by a new and distinctive name, may be regarded by another observer as merely a new form belonging to a genus previously described, while a third savant may go yet further, and say that the plant, or insect, or whatever may be the object under consideration, is not only no new generic type, but has barely any claim to rank as a distinct species. This divergence of opinion leads our professors in two different directions; and while the bent of one man's mind induces him to recognise and describe as distinct, plants which have many points in common, another may go to just the opposite extreme, and err by his custom of referring almost every novelty to some well-known type, of which it must be considered a form or variety. The two opposing schools are characterised respectively in scientific slang as "splitters" and "lumpers," the former finding very thorough-going representatives in the describers of some hundreds of forms of our common Blackberry (*Rubus fruticosus*), while a reference to some of the more recent Colonial Floras will show that "lumping" has its advocates and practisers in very high quarters indeed. As a rule, indeed, it may be stated that those who study only the flora of a limited area, or who devote their attention to a small group of plants, are more likely to detect and lay stress upon comparatively small differences, and so to multiply species, while those who take a wider range and have to deal with the flora of a large province, or the plants of the whole world, are given to take very broad views of what constitutes a species, and to make their definitions so wide as to include a considerable range of variation. Two of our leading English botanists may be cited as offering an example of this. Professor Babington, in his "Manual of British Botany," maintains a large number of species which Mr. Bentham, in his "Handbook of the British Flora," will not allow a higher rank than that of varieties; the former has for the most part confined his attention to the British and European flora, while the latter has devoted himself to research in a wider field, and has probably passed under his notice the greater number of known plants. Each course of action has its good and bad points, and probably the old maxim, *in medio semper tutissimus ibis*, will apply to this as to so many other things.

But, after all this explanation, it will be found that there is a vast difference in the extent of genera. The largest genus of plants known is probably *Senecio*: this is estimated to contain about a thousand species, of which our common Groundsel (*Senecio vulgaris*) is one of the most familiar and ubiquitous examples. Other genera are monotypic, containing but one species; and of these we have an illustration in the Parsley Fern, to which we will now return.











Not only in its technical characters, but in its habit and general appearance, the Parsley Fern is one of the most easily recognised and least variable of European ferns. Looking through a large series of specimens, we are struck with the fact that the variation which exists in all natural objects is here confined within very narrow limits; there is singularly little difference between them, either in size or form. In saying this, we are speaking only of the European form of the plant: the Indian and American forms present differences which have been considered sufficient to entitle them to specific, or even generic rank, although they are now usually considered as varieties of *C. crispa*; but of these we shall speak further on.

The Parsley Fern is a small plant varying from four to eight or ten inches in height, sometimes, though rarely, attaining a foot. The densely-tufted fronds rise from a short, thick, slightly creeping caudex, which is sometimes hardly perceptible; the stipes, which is as long as or longer than the frond, is pale green, smooth, and straw-like. The fronds, which are of a bright green hue, and of a thick, somewhat leathery, texture, are more or less triangular in shape, and from two to three inches across at the base. They are of two kinds, or what is termed dimorphous, thus differing from all the species which we have hitherto described; one kind of the fronds being fertile and the other barren. This dimorphism is not very uncommon in ferns, while among flowering plants it exists in very varied forms, from a slight though permanent and important difference in the stamens and pistils of a flower to a complete change in the habit and general appearance in individuals belonging to the same species. Mr. Darwin has taken a leading position among the botanists who have directed attention to this phenomenon; his papers upon dimorphism in the flowers of the common Primrose, and upon trimorphism in the Purple Loosestrife, were mainly instrumental in attracting to the subject the observation which it has of late years received among naturalists. Among our European ferns, we shall find it more strikingly manifested in the Hard Fern, which stands next upon our list; in certain exotic ferns it is very conspicuously developed—we referred to one instance of it when speaking of the genus *Trichomanes*.

The fertile fronds of the Parsley Fern are, of course, readily distinguishable, when fully developed, by the clusters of brown sori with which they are thickly covered; in a young state these are of a pale yellowish green. The segments are much more narrow and slender in appearance than those of the barren fronds; this is due to the fact that the membranous edges of the segments are turned over upon the sori so as to cover them, thus supplying the place of an indusium, there being no true indusium in this species. Each division of the frond has a somewhat wavy simple or forked vein running down its centre; this produces several smaller veins which reach nearly to the margin of the segments, each bearing a round sorus near its termination. The sori are at first separate, but as they develop they spread out and become more or less confluent, covering nearly the whole surface of the back of the frond. The spores are smooth, and roundish or oblong in form.

The barren fronds are shorter than the fertile ones, and have a more elegant appearance, being less contracted, and offering a much greater variation in form; it is in them that we must look for that resemblance to parsley which has suggested the popular name of the fern, though it must be confessed that this is not always particularly striking. The fronds are divided into alternate or nearly opposite branches or pinnæ, which are spreading, and more or less triangular in form, the lowest being the largest. The segments into which the pinnules forming the pinnæ are divided are more or less cuneate, or wedge-shaped, and oblong, notched at the extremity with two or three distinct teeth. These barren fronds are of a very beautiful green, and their densely tufted habit renders the fern one of very attractive appearance.



Their capabilities from an ornamentist's point of view have already received attention. Mr. G. McKenzie, in the *Magazine of Art*, refers to the Parsley Fern as presenting "forms of leafage which would be of much use to the carver." "In studying from this plant," he adds, "much care and perseverance are needed; the practice followed was to detach the frond to be copied from its neighbours by means of a piece of black silk, which formed a perfect background for the bright green leaf, and then, as in the case of the object, Fig. 1, which was really no larger than a moderate-sized pea, the detail was made out by means of a good magnifying-glass, an instrument which must be used by everyone who would profit by the study of small plants, as in these are often to be found the most valuable lessons. Fig. 2 is a more advanced frond of the same. Fig. 3 is yet more expanded; the whole of the detail of this drawing was found in an object no larger than one's thumb-nail. Fig. 4 is the fully-opened leaf."



CONVENTIONAL TREATMENT OF ALLOSORUS.

The two kinds of fronds—the barren and the fertile—are almost always quite distinct; forms intermediate between them have been recorded, in which, although for the most part barren, fructification is found upon some segments of the fronds; these forms, however, are rarely met with. In Withering's "Arrangement of British Plants" (ed. iii. and others) there is a note stating that "Mr. Jackson has observed two varieties with curled leaves, the one curled

like parsley, the other like the flowering part of *Osmunda regalis*." These two forms of the barren fronds—the one having the obovate segments deeply divided, serrated, and one-nerved, the other with elliptical, deeply serrate, and pinnately veined pinules—are frequently to be noticed if we examine a large series of either fresh or dried specimens of the Parsley Fern. The annexed woodcut, taken from specimens collected in Scotland, shows portions of the fronds of a handsome form of the species which does not seem to be common, although there are other examples of it in the British Museum Herbarium.



VARIETY OF ALLOSORUS.

(1) Fertile Frond. (2) Barren Frond. (3) Pinna (enlarged).

The synonymy of the Parsley Fern is very extensive, as will be at once apparent when we state that it has had as many as eleven generic names. It was originally described by Linnæus as an *Osmunda*—a fact which may seem strange to those who understand that genus as it is now limited, but which ceases to be surprising when we remember that in former days it had a much more comprehensive scope, and included, besides other ferns, the *Struthiopteris*, the Hard Fern (*Blechnum Spicant*), and the Moonwort (*Betrichium Lunaria*), in addition to the subject of



the present notice. Later on Linnæus referred the plant to *Pteris*, with which genus indeed, although so different in habit, it has several points in common, such as the folding over of the margin of the segments of the fertile fronds so as to form a false indusium. The common English book-name for the species, "Rock Brakes," bears witness to the time when the Parsley Fern was placed in the same genus with the common Brakes (*Pteris aquilina*). It is unnecessary to notice any of the other generic synonyms of the Parsley Fern with the exception of two—that under which it is described in these pages, and another one by which it is at least as often referred to, *Allosorus*. The name *Cryptogramma* was given by Robert Brown, who defined the genus in 1823, and is from the two Greek words, *crypto*, hidden, and *gramme*, a line, in reference to the lines of the fructification being concealed. Sir W. J. Hooker, pointing out this derivation, considers Brown's spelling to be inaccurate (as no doubt it is), and writes the name *Cryptogramme*. In this he is followed by many botanists; but this alteration in spelling is hardly in accordance with botanical laws of nomenclature, according to which the name under which a genus was published must be accepted as the recognised designation of the plant, and even the original spelling must be adhered to, unless in very exceptional cases. This rule might seem strange to those unacquainted with scientific terminology, and indeed outsiders might be excused for considering entirely wasted much of the ink and paper which has been devoted to what seems very trifling questions of nomenclature. The question of the right way of spelling *Cinchona*, for example, has given rise to a controversy of considerable extent. This name was intended to commemorate the Countess of Chinchon, who was the wife of a viceroy of Peru. Having been attacked with fever, a packet of powdered bark was sent to her physician by a native of Loxa, who assured him that it would prove efficacious in the treatment of her disease. The drug fully bore out its reputation, and the Countess was cured, and upon her recovery she caused large quantities of the bark to be collected, which she gave away in the form of powder to those sick of fever.\* It was probably owing to this that the drug was introduced to Spain, and thence spread through Europe. Its employment by the Countess took place in 1638; it was not until 1742 that Linnæus founded the genus *Cinchona*. There is no doubt but that in so doing he intended to commemorate the Countess of Chinchon; and it has of late years been strongly urged that the spelling of *Cinchona* should be altered to *Chinchona*, and some writers on quinine and its sources have gone so far as to adopt this form. But the word *Cinchona* has been so thoroughly established, and so many derivatives have originated from it, that the proposed alteration has never been generally adopted, nor is it likely to become so. It has been pointed out that Linnæus also wrote the name *Cinhona*, a form of spelling which, however, may be owing to a blunder of the printer. In spite of Shakespeare's implication to the contrary, there is really a good deal in a name; and a very interesting chapter might be written on the subject of commemorative names alone. In many instances, as Linnæus himself tells us, these titles were bestowed on account of some fancied resemblance between the plants to which they were given and the botanists whom they commemorated: thus, for example, the genus *Bauhinia*, named after the brothers Caspar and John Bauhin, has a two-lobed or twin leaf; *Scheuchzeria*, a grassy Alpine plant, is so called in order to bring to our minds the two Scheuchzers, one of whom had a great knowledge of Alpine plants, and the other an extensive acquaintance with grasses. Sometimes such names were not complimentary—for instance, *Buffonia tenuifolia*, an insignificant plant, is said to have been so called

\* Any one curious to see how much of interest and history may be associated with so simple a matter as the introduction of a drug should consult the account of *Cinchona* bark, given in "Pharmacographia," pp. 304–309.

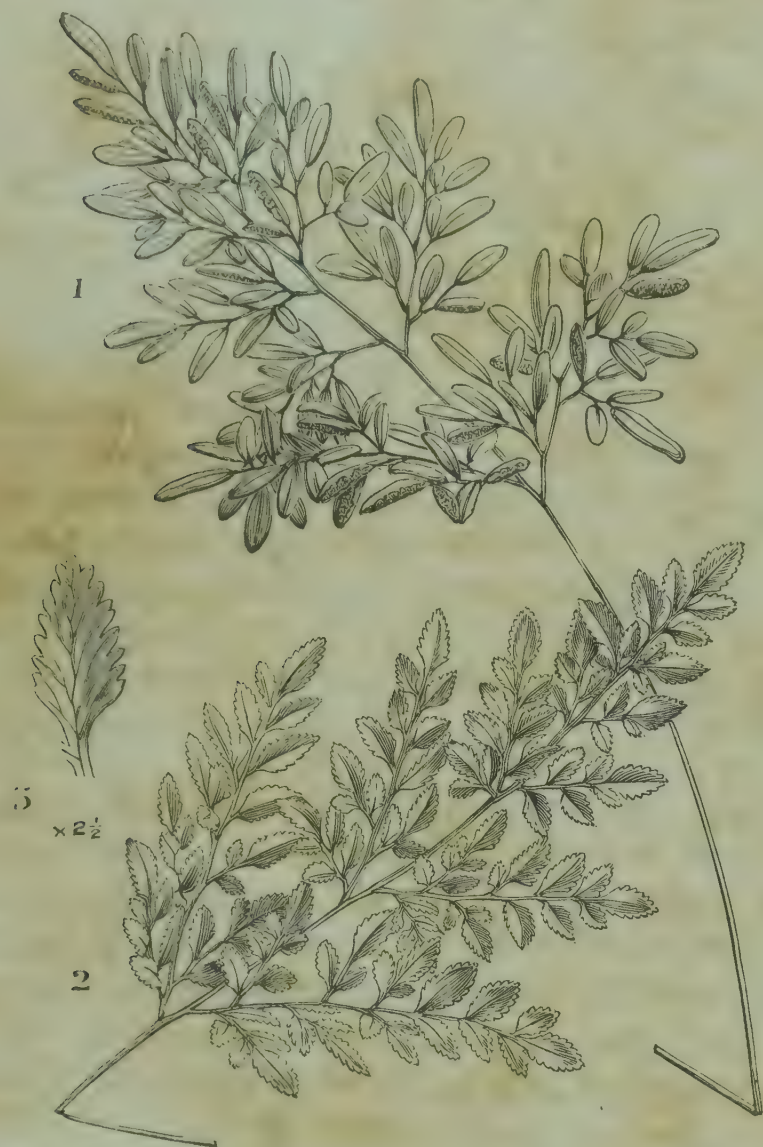


in memory of the great French naturalist, whose pretensions to botanical knowledge were very slender.\*

The genus *Allosorus* was established by Bernhardt in 1806, and then included numerous species of ferns. Many of these, however, have been transferred to other genera, and the Parsley Fern is now the representative of the genus. The name is derived from two Greek words—*allos*, various, and *sorus*, a heap, the intention probably being, as Mr. Moore

observes, "to indicate the variation in the arrangement of the sori occurring among the plants originally thought to belong to this family. It may also apply to the apparent difference of arrangement in the sori of this plant at different stages of development, the young sori forming distinct roundish patches, and the older becoming effused into larger shapeless masses." It may, however, perhaps have been intended to refer to the difference between the barren and fertile fronds.

In the "Synopsis Filicum," following Sir W. J. Hooker in the "Species Filicum," two ferns at one time regarded as distinct from the Parsley Fern are placed under it as varieties. Milde also follows this arrangement, while Mr. Thomas Moore opposes it, and considers the two plants alluded to to be even generically distinct. One of these, *C. Brunoniana* of Wallich, is a native of Northern India, ascending in the Himalayas to from eleven to thirteen thousand feet: the other, *C. acrostichoides* of Robert Brown, is a plant of North, and especially North-Western, America. These Mr. Moore considers as distinct, basing his opinion on the difference in the receptacles, which are linear and oblique in the two plants just named, while in the Parsley Fern they are puncti-



CRYPTOGRAMMA ACROSTICHOIDES.

D.B. del

(1) Fertile Frond. (2) Barren Frond. (3) Pinnule (enlarged).

form. He says, "We follow Mettenius and others in keeping them distinct, on account of the difference in the receptacles, to which we attach considerable importance. In the typical species of *Cryptogramma*, the sori form short lines along a portion of the veins, after the gymnogranmoid type, and these lines being parallel, and near together, unite laterally as they become effused, and so form a broad linear mass transverse to the veins. In *Allosorus*, the sori instead of being elongated are punctiform, but they become laterally confluent in the same way as in *Cryptogramma*; and in some states of the plant a tendency to elongate is perhaps also to be observed." The two genera are

\* This, however, has been controverted. See "Journal of the Linnean Society," ii., 183—190 (1858).



undoubtedly very closely united, and in habit and general aspect they are quite similar; the recent and careful observations of Milde entirely support Hooker's view, and from these the author referred to states very definitely that the two genera can in no way be retained, and that all the forms are referable to the species.

The Indian form, *C. Brunoniana*, is an erect, stout plant, of somewhat rigid habit, the barren fronds being quite like those of the European form, though the fertile ones more resemble those of the American variety: the segments of these are oblong, "about three lines long and one line broad, with the involucre spreading in the mature plant and a space left free from fruit in the centre." This occurs in various parts of Northern India, ascending to thirteen thousand feet in the Himalayas. *C. acrostichoides*, the North American form, of which we give a woodcut, is altogether a larger and stronger plant, with thicker and more prominently veined barren segments, which also are not so deeply cut; the stipites are more robust, and the chaffy scales are longer in proportion; the fertile pinnules also are larger, broader, and more flattened, with the involucre spreading as in the Indian form. This is especially a North-West American fern. It was first found by Menzies at Nootka Sound, and then by Sir John Richardson in the Hudson's Bay territory, between fifty-six and sixty degrees north. Douglas collected it in 1825-27 in various localities in the Rocky Mountains, about the Columbia River: his specimens are certainly more luxuriant than any of the European examples we have seen, the fertile fronds being nine inches or more high, and stout in proportion. Other North American specimens, however, according to Sir W. Hooker, possess quite the European form; but statements of this kind, after all, seem to depend a good deal upon the ideas which those making them have formed of the type of a species; for while the author just quoted says that specimens from Isle Royale, Lake Superior, agree entirely with the Parsley Fern of Europe, Professor Asa Gray retains the name *acrostichoides* for the Isle Royale plant, although he says it is "very near *A. crispus* of Europe." The interest of this locality lies in the fact that it is the only one known for the plant in the United States.

Besides these two forms, which have some claim to be considered distinct, Milde\* describes two others, *A. Stelleri* and *A. sitchensis*. The former is only a depauperated form of *A. crispus*, with a very slender rhizome, and fronds which are sometimes barren at the base and fertile towards the apex. This is a native of Siberia and the East, and of India. Milde says that he has seen North American specimens which entirely agree with the Asiatic plants. It has also been called *A. minutus*. *A. sitchensis*, which Milde places between *A. acrostichoides* and *A. Brunonianus*, has very small, minutely denticulate ultimate segments; it is only known from Sitka, but the author already quoted says it is certainly not specifically distinct from *A. crispus*. He also says that he possesses an example of *A. crispus* from the Salzburg Alps, which unites in itself the varieties *Stelleri* and *acrostichoides*. The upper part of the frond is fertile and the lower barren, while the segments of the barren portion accord with *acrostichoides*. Forms of *crispus* approaching *Brunonianus* are, according to Milde, much more frequent; and a careful study of his minute and detailed observations, based, as they evidently are, on the examination of a very large series of specimens, seems to point to the accuracy of the conclusion that the whole are but forms of one and the same species.

It may be interesting to enter upon a somewhat more detailed account of the geographical distribution of *C. crispa*, considering it in its more restricted acceptation, and hence excluding from our present estimate the forms just described.

\* "Filices Europæ et Atlantidis," p. 26.



Beginning with our own country, we shall find that the Parsley Fern is frequent on the mountains in many parts of Scotland and the north of England, with a few outlying stations further south, some of which, however, certainly require verification. This is the case with the Devonshire locality, for example: Mr. N. B. Ward recorded the finding, in 1840, of a single plant of this fern, "at or within six miles of Lynton, North Devon," and what appears to be the same locality has been recorded for it in somewhat different terms in various works. But from the way in which the Somersetshire locality for the plant is recorded by Mr. Newman, it seems most probable that the Devonshire locality should be altogether suppressed. Mr. Ward\* says the fern was found "in company with *Polytrichum alpinum*," near Lynton, as already quoted; Mr. Newman† has no mention of any Devonshire locality, but under Somersetshire says, "I am indebted to Mr. Ward for a specimen found in 1840. The plant grows very sparingly on a stone wall, about a mile from Simonsbath, in company with *Polytrichum alpinum*." The wording of these two records leaves little doubt that the same locality is intended in each case, and the occurrence of the Parsley Fern in Devonshire must be considered as requiring confirmation. Worcestershire and Shropshire each have one locality for the Parsley Fern: in the former county it grows sparingly on the eastern side of the Herefordshire Beacon, and in the latter on Titterstone Clee Hill. There is an old record for it in Derbyshire, and it is stated on more recent authority to occur in Cheshire. As we go further north the Parsley Fern becomes more abundant; it has numerous localities in Lancashire, although in some of them it is extinct, or nearly so, and is also found more or less plentifully in all the northern counties. In many parts of the Lake district it is very abundant, so much so, indeed, as to attract the attention of even non-botanical tourists, who cannot fail to be struck with the charming contrast afforded by its delicate fronds growing in masses around the dark slaty rocks. Plentiful in many parts of the district, it is nowhere more abundant or more beautiful than at the foot of Honister Crag, where it grows in company with the beautiful silvery Alpine Lady's Mantle (*Alchemilla alpina*) and other interesting plants. As might be expected, the Parsley Fern did not escape the notice of the Lake poets, although they do not seem to have enshrined it in verse. Southey, however, calls it "the most beautiful of all our wild plants, resembling the richest point-lace in its fine filaments and exquisite indentations;" while we read in Wordsworth's Memoirs, how "suddenly stopping before a little bunch of harebell which, along with the Parsley Fern, grew out of the wall near us, he exclaimed 'How perfectly beautiful that is!'

"Would that the little flowers that grow could live  
Conscious of half the pleasure that they give!"

The Parsley Fern is recorded as having been found in most of the Welsh counties, but we have no notice of its occurrence in Pembrokeshire, Anglesea, and Flint. In Caernarvonshire it has a considerable range of elevation; it is found on stone walls between Llanberis and Caernarvon, at a very slight altitude above the sea-level, while it ascends to the very summit of Snowdon, and is found also, though in small quantity, upon most of the mountains and hills of the county. In Scotland the Parsley Fern is widely distributed, extending to Caithness, although absent from some few counties, and not growing very plentifully in some others: it occurs in the Hebrides, but not in the Orkney or Shetland Isles. In Ireland it is quite local, occurring only in the east and north-east; it grows in the counties of Louth, Down, Antrim, and Derry, ranging in altitude from one thousand feet in Derry, to two

\* "Phytologist" (1842), p. 21.

† "History of British Ferns" (1844), p. 105.



thousand four hundred feet in Slieve Bingian, co. Down. Several of the recorded Irish localities require confirmation. It is said to have been found near Belfast, but was there probably planted.

On the continent of Europe (to which indeed, with the exception of the British Islands, the typical Parsley Fern seems to be confined) it is widely, though by no means universally, distributed. It is abundant in Lapland and Finmark, extending to Greenland, and occurs in the North of Sweden, and throughout the greater part of Norway. Coming farther south, we find it in Hungary and Belgium, though not in great abundance; on the Swiss Alps, and in the sub-alpine parts of Switzerland; in Lower Austria, Styria, and the Tyrol. It occurs in Piedmont and in several parts of France, notably among the mountains of Dauphiné and in the Pyrenees; crossing these, we find it also in Spain, in the highest region of the Sierra Nevada, and ascending to ten thousand feet on the Picacho de Veleta. It seems to be entirely absent from Portugal. Going east, we meet with it upon Mount Olympus, and it is recorded as occurring in Siberia. This may be regarded as the limit of the Parsley Fern, if we take a restricted view of the plant; but if, as seems most in accordance with the evidence produced, we take a more comprehensive view, and include under the same species the Indian *Allosorus Brunonianus* and the American *A. acrostichoides*, we shall of course take a much more extended estimate of its geographical range.



ALLOSORUS CRISPUS.



## BLECHNUM.



WE have here a genus of ferns which is generally regarded as sufficiently distinct for separate mention, but some members of which in many points—notably in general appearance—resemble so closely another genus, *Lomaria*, that its solitary European representative, *B. Spicant*, is often referred indiscriminately to both, some authors calling the plant *Blechnum Spicant* or *B. boreale*, while others style it *Lomaria Spicant*. It is one of those cases in which, if guided only by general resemblance, we should certainly place the two genera under one head; the contraction of the fertile fronds, which is sometimes given as a characteristic of *Lomaria*, is certainly manifest enough in our common Hard Fern; but the technical difference between the two must be sought for elsewhere. Mr. Moore has put this so clearly that we cannot do better than avail ourselves of his observations on this point. He says:\*

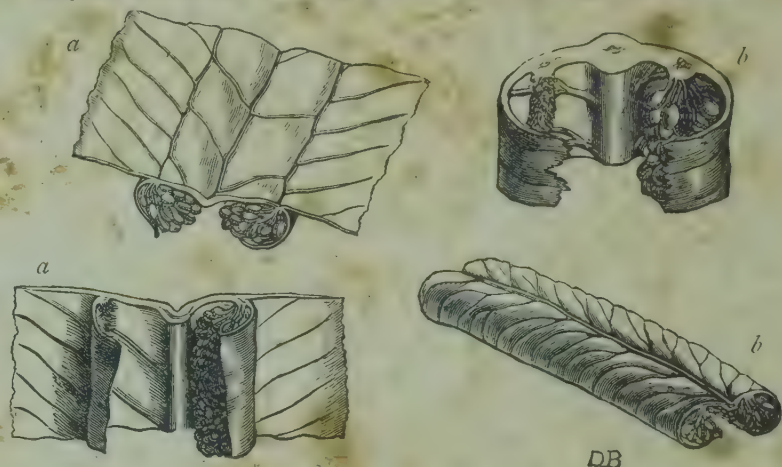
"The distinction between *Lomaria* and *Blechnum* becomes easy when full force is

given to the technical characters assigned to each respectively. The peculiar characteristic of *Lomaria* is that the sori are produced at the margin; whilst the characteristic of *Blechnum* is to have the sori distinctly within the margin, and near to the costa. Thus in technical and exact terms, the sori of *Lomaria* are marginal, and in *Blechnum* costal or intramarginal.

The fructification of *Lomaria* is determined by the indusium being a continuation of the margin of the frond, which becomes membranaceous, and is inflected over the spore-cases.

The fructification peculiar to *Blechnum*, on the other hand, is known by the indusium springing directly from the under surface of the frond, the margin extending beyond. This is a clear and intelligible difference, and the genera are only satisfactorily divided when these peculiarities are allowed to have full force." The accompanying figures will show the technical distinction between the two genera.

The "Synopsis Filicum" enumerates thirty-nine species of *Lomaria*, several of which are in cultivation. They are widely distributed, occurring principally in the South Temperate Zone, but having representatives in most parts of the world, although—unless we regard the Hard Fern as a *Lomaria*—finding no place in the European flora. *L. attenuata* is a widely-spread species, occurring in both the Old and the New Worlds—in the former in Polynesia, Norfolk Island, the continent of Africa (Fernando Po, Cape Colony, etc.), and in the Mascarene Islands; in the latter from Guatemala southward to Brazil and Juan Fernandez, and in the West Indian Islands. It is a handsome evergreen plant, from a foot to two feet in height, having a somewhat climbing woody root-stock, which is thickly covered with dark brown hair-like scales. The barren fronds are rigid and rather leathery in texture, quite smooth on both



(a) PORTION OF FROND OF BLECHNUM (ENLARGED) SHOWING POSITION OF SORI. (b) DITTO OF LOMARIA.

\* "Nature-printed British Ferns" (octavo edition), ii. 208.







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ಗ್ರಂಥಾಲಯ  
ರಾಲ್‌ಫ್‌ಫಾಗ್, ಬೆಂಗಳೂರು

ಡಾ|| ಎಂ.ಹೆಚ್.ಮಲಿಗೌಡ ರಾಷ್ಟ್ರೀಯ ಗ್ರಂಥಾಲಯ

ಶಾಲಾಬಾಗ್, ಬೆಂಗಳೂರು - 560 004

ಪ.ಸಂಖ್ಯೆ:...

ವ.ಸಂಖ್ಯೆ:.....

ಗ್ರಂಥ ಹಿಂದಿರುಗಿಸುವ ದಿನಾಂಕ ಬಿಡು

ಈ ಕೆಳಗೆ ಕಾಣಿಸಿರುವ ದಿನದಂದು ಅಥವಾ ಅದಕ್ಕೂ ಮುಂಚೆ ಈ ಪುಸ್ತಕವನ್ನು ಹಿಂದಿರುಗಿಸಬೇಕು. ಅಥವಾ ಮುಂಚಿತವಾಗಿ ನವೀಕರಿಸಬೇಕು. ಇಲ್ಲದಿದ್ದರೆ ದಿನಕ್ಕೆ ರೂ.1.00 ದಂಡ ಪೊಡಬೇಕಾಗುತ್ತದೆ.

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ಪು.ತಿ.ನೋ..



ವ. ಸಂಖ್ಯೆ \_\_\_\_\_

**ತೋಟಗಾರಿಕೆ ಇಲಾಖೆಯ  
ಗ್ರಂಥಾಲಯ**

**ಲಾಲ್‌ಬಾಗ್, ಬೆಂಗಳೂರು-560 004**



